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**Illustrated.*

The Engineering and Mining Journal

APRIL 15, 1911.

The Flotation Processes

At almost all times in recent history the gaiety of the metallurgical industry has been enlivened by some long drawn out campaign in patent litigation. About the time when one set of litigants has become tired out, the lawyers having absorbed their substance and the public having been taught that it need not pay royalty to anybody anyhow, another company of players has been ready to appear upon the stage. Thus was the cyanide litigation followed by the roasting-furnace cases, and they in turn by the matter of the filter processes. The last, even, has not yet been finished, but most people are now tired of reading about it, and the flotation litigation must be conceded to be the present center of interest.

The litigation over the flotation processes is a good Kilkenny fight. Everyone who has got a shillalah is hitting every head in sight. The Elmore people are suing Minerals Separation and the latter are suing back. Cattermole, De Bavay and Potter are suing or being sued In fact, almost everybody is suing almost everybody else, while concerns that own no patents are drawn in to the vortex. Thus the Elmore people are suing the Zinc Corporation for abandoning their process and substituting that of the Minerals Separation Company, and have instituted proceedings in Germany against the Metalgesellschaft, of Frankfurt, because it has been importing zinc concentrates made by oil-flotation processes not licensed under the Elmore patents.

The recent announcement that the Zinc Corporation has resolved to alter its large treatment plant at Broken Hill, and install the so-called Minerals Separation process instead of the so-called Elmore process, has not attracted the attention it merited, because of the light that it throws on the whole situation as regards the flotation processes and patents. This action emphasizes the fact, always well known, that most of these so called flotation processes, as patented by Elmore, Potter, Scammell, Delprat, Sulman, Picard, Ballot, Wolf, De Bavay, Cattermole, etc., are founded on the process invented by an American woman, Carrie J. Everson, and secured by her in U. S. Pat. 348,157, Aug. 24, 1886. The process was described in the JOURNAL nearly 20 years ago with an account of its trial at Baker City, Oregon.

Miss Everson was a school teacher in Oregon. How she happened to direct her attention to the separation of minerals and how she chanced upon the then novel process that she described, we do not know. We understand that her brother was an assayer and it is not unlikely that through her association with him she became interested in metallurgical research. Anyway, it is evident that her patent was not drafted to secure to her a mere dream of what might be done, but rather was it based upon something that had been done. Also it is evident that her ideas were not lightly dismissed, her patent having been taken out in 1886, while in 1891 practical trials of her process were being made. The account of one of the latter in the JOURNAL of Nov. 15, 1891, is of peculiar interest, and we reproduce it *in extenso,* as follows:

From Our Special Correspondent

Baker City, Ore., Nov. 10.

Quite a number of capitalists from Portland and Walla Walla are here, watching the result of some test working of the "Criley & Everson Oil Process" for the extraction of sulphurets from any ore, as the name signifies, by the use of oil. Your correspondent witnessed a test made on the Eureka & Excelsior ore, which was conducted as follows: The ore was crushed and passed through a 50-mesh sieve, weighed and thoroughly mixed with black, thick oil. To water heated to near boiling was added enough sulphuric acid to give it a tartish taste. This acidulated water was then mixed with the mass of oil and ore. A thick scum of sulphurets rose to the surface and was skimmed off, leaving the hitherto black ore as white as snow—in fact, pure silica. The gentlemen express themselves as pleased, and the citizens of Baker county are in hopes they are, because it means the erection of a large plant at this point.

In this description we might imagine that we were reading of a test of one of the recently exploited processes.

Most of the later patents on processes have been merely refinements of Miss Everseon's process. They are chiefly notable because they introduce complexities of materials, machinery and appliances. Now the Zinc Corporation has swung around to the beginning of things and is installing a process which in all its essentials was described by Miss Everson.

Her process as she described it, consists in mixing with pulverulent ore an oil, an acid and water, finally breaking up the mass to allow the sand to separate therefrom, and washing out the gangue with water containing an acid. The proportions in which the acid is added may be varied. In practice upon large masses, she said, any vessel having an outlet at the bottom for the sand and water would be suitable. In practice, the concentrate, after thorough agitation of the mass and detachment of the sand, would be preferably removed by means of a constant overflow of water from a washing-out vessel, by which overflow the concentrate would be floated off. A proper selection of devices for this purpose would be apparent to those skilled in the wet concentration of ore.

This patent expired long ago in all the countries where it was taken out. Its first claim was as follows: "In the separation of pulverulent ores containing a rocky gangue, the method of treatment herein described, which consists in mixing with such pulverulent ore a fat or an oil or a constituent thereof, an acid or soluble neutral or acid salt, and water, finally breaking up the mass to allow the sand to separate therefrom."

Such then, in all its essential principles is the process which by its introduction at the works of the Zinc Corporation we can assume is the best development of the art. It marks a reversion to the original idea and establishes once and for all that an American woman was the real inventor of the process of ore concentration in which oil and acid are used to float certain minerals that it is desired to separate. The later patents apparently cover but little more than details and apparatus.

The only other early patent of any interest on this subject was one taken out by Alcide Froment in Italy and Great Britain only. The British patent was No. 12,778 of June 4, 1902. As it was taken out only in those countries, it is free and open to all users in other countries. Froment's process consisted in mixing the finely crushed ore with water, adding a suitable oil, and then liberating a gas (air is the best one) in the mixture. This operation results in the sulphides being carried to the surface in the froth.

American millmen need have little fear from the consequences of using a process described in two patents—one 25 years old and the other of which was only taken out in Italy and Great Britain. The patent litigation can wax fierce in loud clamour or wane feebly in futile asservation and it need not bother the *bona fide* user of a good but old metallurgical method, providing he does not infringe some special apparatus, which the Zinc Corporation has proved, to its satisfaction, to be quite unnecessary anyway.

American Electrochemical Society

The nineteenth general meeting of the American Electrochemical Society, held in New York last week, was a noteworthy gathering. This is perhaps the most active of the technical societies concerning themselves with chemical and metallurgical subjects. The organization is prosperous, its membership is rapidly growing and its meetings are well attended.

The excellent attendance and the unflagging interest that inspires the attendance are results of which other technical societies may rightly be envious. Here is none of the stagnation from which many other societies suffer. Therefore it is worth while to pause to examine the conditions that contribute to make the American Electrochemical Society so live an organization.

In the first place it possesses a very earnest, energetic and self-sacrificing secretary. Without such an officer no technical society can succeed, but even such a one as Prof. J. W. Richards would make no great headway unless his leadership were in a cause exciting widespread interest. The membership of his society find that in the development and exploitation of the new art of electrometallurgy, or more broadly we should say electrochemistry.

This field is especially attractive because it has been little plowed as yet, and that which has been done has turned up some rich prizes. Although an important literature is being created rapidly, it is not yet rich, and consequently the men who are giving attention to the new art like to get together to compare notes, to discuss experiences and in short to learn. That is what makes attendance at a meeting of the society a thing that is well worth while.

The older societies would have cause for congratulation if they could bring their members together in the same spirit. Indeed, some of them do that to a more or less extent. However, it may be remarked that in the electrochemical society there is a singular concentration of interest, a deep concern as to subjects whereof knowledge is thirstily sought, and an active exploration of new fields. In brief the art is new and the society is new, and as in all new things that are worth while interest is easily inspired and maintained.

Gold and Silver in India

A remarkable tendency, to which some reference has previously been made, is the disposition of India at present to take gold in place of some of the silver which it has habitually purchased—and hoarded—for many years past. In part this has been attributed to the heavier import duty on silver levied by the Indian government for two years past; but in larger degree it seems to be the result of greater prosperity, which puts gold within the reach of large numbers of people who have heretofore been limited to silver by their small means.

The trade returns of India for the fiscal year ended with March show that the imports of gold for 1910-11 were approximately $50,000,000. Now, for 30 years previously the average amount of gold imported—and retained—in India was $19,000,000 yearly; and up to 1909 the amount did not vary greatly from year to year. The Indian government reports a marked increase in the demand for gold coin, though the main bulk of circulation has always been in silver.

The tendency to hoard gold rather than silver may have a decided effect on the silver market in the future.

The copper statistics for March were unfavorable from all angles of view. The enormous production has naturally inspired the inquiry: "What has become of the curtailment?" As we have previously remarked, however, too much analysis should not be devoted to the statistics of a single month.

Correspondence and Discussion

The Canadian Mining Law

I have read with much interest the illuminating remarks contributed by Dr. R. W. Raymond in the form of a discussion of J. M. Clark's paper "The Canadian Mining Law," printed in the JOURNAL of April 1. The significance and importance of the present endeavor to provide for the introduction and establishment of a model mining law in Canada can not be overstated. The effects of such a measure must necessarily be far-reaching, and if the high aims of its promoters are attained, stimulatingly beneficial. In view of the fact that so considerable a proportion of the capital invested in Canadian mines is derived from the United States, a proposal such as the present to simplify the conditions under which title may be acquired and to insure its stability by statutory enactment in place of existing uncertainties of procedure and system, is of no less concern to Americans than to ourselves.

LEASEHOLD SYSTEM ADVOCATED

The campaign to bring about a reform in this direction was inaugurated several years ago, but was not brought to a head until quite recently, when, in consequence of the determined and persistent efforts of the Canadian Mining Institute, the prime minister, Sir Wilfred Laurier, consented to introduce a bill into parliament on the understanding that the institute would assist by enunciating the principles on which the law as proposed would be based. These fundamentals were duly submitted to a parliamentary committee, and, being approved, Mr. Clark was deputed by the minister of mines to draft a bill in accordance therewith. One of the principles advocated was that the basis of tenure should be leasehold, and it is here noted that Doctor Raymond expresses a preference, although not very emphatically stated, for the system of granting title in fee simple. His experience is such that his views on this point are worthy of the most respectful attention and it would be most interesting if he would explain more fully the grounds on which this judgment is founded.

INADEQUATE TAX

In advocating, meanwhile, a leasehold system, the institute was actuated by several considerations, chief among which was the recognized difficulty of securing the reversion of property to the Crown once it had been alienated. In British Columbia, for example, the greater portion of "Crown-granted" claims are unworked; much territory is in consequence indefinitely "tied up," and development

Views, Suggestions and Experiences of Readers

of potential resources thereby retarded. It is true a tax on unworked Crown-granted claims is imposed, but the amount, $13 per annum for a full size claim of 52 acres, is inadequate. An adequate tax should be at least equivalent to such annual rental as the government might reasonably exact where leasehold is the basis of title. The institute, desiring to provide for the easy reversion of unworked land to the Crown, decided to recommend a middle course. The principle of leasehold was upheld, but an objectionable feature of the leasehold system, to which Doctor Raymond refers, was eliminated by advocating the granting of a long period, in fact, what is virtually a perpetual lease, (since a term of ninety-nine years may be so regarded), conditional on the payment of a fixed annual rental. To all intents and purposes such a form of title is as valuable, permanent and secure as freehold. The institute was also influenced in favor of leasehold by the comprehensive report made by A. C. Veatch to the United States government, on the operation of the mining laws of Australasia, in which he clearly proves that the change of tenure systems from freehold to leasehold in that country stimulated development and induced industrial activity.

WORK ACCEPTABLE IN LIEU OF RENTAL

Again, representatives of the more important London firms engaged in the operation of mines in various fields through the world, who, upon visiting Canada, have been asked to give their views on the subject, have displayed a remarkable unanimity in favor of the leasehold system. This also carried weight in the determination of the point. Doctor Raymond's contention that "work" should not constitute a condition of possession, is incontrovertible.

The institute took this viewpoint, for the imposition of no such condition is suggested in its recommendations. On the other hand, a proposal affording leaseholders the option of "work" in lieu of the payment of rental, is put forward and has much to recommend it, having regard in particular to the interests of prospectors. The recommendation in question reads as follows: "That rentals be based upon the acreage and paid in advance at the rate of $1 per annum. Work done on any claim to the extent of the rental, but only where work alone amounts to at least $200 in any one year, is to be received in lieu of rental for that year." Of course, there is one serious objection to the inclusion of such a provision in a mining code and that is, it implies the necessity of appointing inspectors to undertake the duty of verifying the statements of claimholders in this respect; for unless some system of verification is adopted, this optional "working provision" would be rendered just as "delusive and useless" as Doctor Raymond states are the requirements of the United States code in respect of "assessment work."

THE DISCOVERY CLAUSE

It is to be expected, however, that in attempting to legislate in the interests of more than one class, in this case capitalists and prospectors, minor difficulties will arise, but in general the aim of the institute has been to secure the passage of a law that will be as free from superfluities as possible. In other words, as clear as possible and as simple as possible, leaving no loophole whereby a man may be dispossessed of his rights in consequence of arbitrary powers vested in officials. Thus the following recommendation: "The prospector shall not be obliged to make discovery of mineral in place to the satisfaction of anyone, but having made what, by him, is believed to be a discovery of mineral in place, he is to be permitted to stake out a claim and then record it in the government recording office at a nominal fee, on doing which a lease is to be issued to him, which lease is to be perfectly free from any condition dependent on the opinion or report of officials."

If the requirements as regards "assessment work" have proved "delusive and useless," how much more so the conditions (included in both the British Columbia and Ontario acts) in respect of "discovery." In British Columbia the courts have decided that any work *in situ* constitutes "discovery." In Ontario the provision of the act is at present ignored, yet its inclusion has been a fruitful source of litigation, grievance and hardship in both provinces. Doctor Raymond's dictum that one of the first duties of a government is to provide for a survey of all public lands, is without doubt true; but in a sparsely populated country of the enormous extent of Canada, having, as it has, an area of 3,729,665 square miles, the colossal nature of such an undertaking must be apparent, the accomplishment of which under the

most favorable circumstances must be spread over a considerable period of time. Provision should, however, and no doubt will, be made for the location of claims in such a manner to admit of the easy adjustment of boundaries to conform with the lines of a subsequent official survey. In fact, the present regulations contain provisions having this end in view.

H. MORTIMER-LAMB.

Secretary, Canadian Mining Institute.

Montreal, April 7, 1911.

Cooperation in Research Work

In this age of coöperation, specialization and industrial efficiency, it is rather strange, on the whole, that men engaged in practical work do not coöperate with those engaged in research and scientific work in our various engineering colleges.

Many problems of economic importance, especially of a metallurgical and chemical nature, are capable of solution by the man who is engaged in scientific work along similar lines, especially when coöperating with someone who is acquainted with all of the "hooks and crooks" of practice. There are at least three marked advantages possessed by the scientific over the practical, insofar as concerns environment, in the solution of these problems, which it is possible to solve apart from the plant: (1) The scientific man has at his disposal apparatus, chemicals, etc., which are not, as a rule, within reach of those in practice. (2) He has, as his associates, specialists in many of the allied subjects. With these he can consult at any time. (3) Last, but not least, he is surrounded by the spirit of investigation, as everyone who is carrying on work of an investigative nature should be.

Why this coöperation, which would render industrial as well as scientific efficiency much greater, does not take place to a larger extent, is due, in most cases, to the individual rather than class prejudices. At least the difficulties which render it so infrequent, will have to be overcome in each case rather than in a class.

RAYMOND C. BENNER.

Tucson, Ariz., March 31, 1911.

Seeking Employment

The letter of B. B. in the JOURNAL of March 25 touches a vital matter. Some time ago I was amazed to note the receipt of some 200 applications in answer to an advertisement for a mine surveyor for a wild part of Mexico, $150 salary.

It is possible that too few engineers realize the obvious facts: that mining engineering is more mining than engineering; that our engineering qualifications are of small value unless combined with thorough mining knowledge; that while it is easy to reach the position of assistant superintendent in mine operation through our school training and a little desultory underground experience, the position of the superintendent requires also a thorough knowledge of the mine foreman's job, for continued success; and consulting and examination work require a preliminary varied experience as superintendent.

"Mining is taking ore out of the ground with men and machinery at a profit," and the mining engineer must "know ore," how to take it out and must know the mine, the men and the machinery. The "feel of the mine" can only really be got by working underground breaking ore with one's own hands.

It is no loss of an engineer's time to put in two years working for day's pay as a miner, underground, in dividend-paying mines, in as many different districts as possible. As one result, his acquaintanceship will then make it unnecessary to advertise for a salaried position. A couple of years of manual labor does not dull a man's intelligence irreparably and in any case the gain in the human broadening of the mind, outside of the knowledge gained, is well worth a slight temporary loss in mental brilliancy. "Back to the mine" would be a good slogan. Taking a lease of a mine or part of a mine and endeavoring to work it profitably would show many engineers why they are not in demand.

WILLIAM H. HENDRICKSON.

Eureka, Utah, April 4, 1911.

Technical Reports

It has recently been my misfortune to be forced to go through a great many reports of examinations of mining properties. These reports were of all sorts, having been made by various engineers and "near engineers." However, the more of these I read the more strong became my conviction that the exercise of more common sense and less parade of technical vocabulary would insure more valuable reports. This, at times, approaches a question of consideration for the audience.

Instead of straightforward presentation of fact, which is what the business man requires, technical reports too often embody—are obscured by—a mass of unnecessary theorizing serving only to mystify the reader and provide a display of the writer's knowledge of technical terms.

The evident attitude of this class of report writers (I will not call them engineers) is well illustrated by the following story: A professor of mining in one of the big universities and a long-time friend of an old miner, visited the latter's prospect one day. The two men went through the workings and in the course of the examination the professor turned to his friend and said, pointing to the wall of the tunnel, "Ed. that looks like a cataclastic conglomerate." Nothing further was said on the subject, and after enjoying a bite to eat and a smoke together, the professor took the trail down to the nearest railway station. Just as the professor was boarding his train he spied his friend running at full speed down the trail. As the train started the old miner, realizing he could not get there in time, shouted, "Say, Prof., what did you call that spotted-looking rock in the tunnel." The professor answered, "Cataclastic conglomerate, Ed." The answer came back, "All right, Prof., I'll fix the next one of them fancy-talking young engineers that comes in my diggins."

B. S. WALKER.

Butte, Mont., Feb. 10, 1911.

The Clancy Process

It will be seen from reading Mr. Mosher's article on the Clancy process recently published in several of the mining journals that there is no ground for the comments and figures which he has given.

If Mr. Mosher wants cheap cyanide and thinks he has it in calcium cyanide, it has nothing to do with me. I do not use calcium cyanide nor attempt to produce it from cyanamide. In all cyanide plants using lime, surely a certain amount of calcium cyanide may be formed. Would Mr. Mosher then attempt to restrict the use of lime in the cyanide process unless he is paid a royalty?

That Mr. Mosher has shown in his writings that he does not use cyanamide or calcium cyanamide, may be seen from the disparaging manner in which he speaks of my use of cyanamide in conjunction with the cyanide solution. He goes on to state how he cannot see any value in the use of cyanamide other than protecting the cyanide through reducing the cyanate by means of the NH_2 group present in the cyanamide and forgets that when I use oxidation means other than the atmospheric oxygen, a considerable proportion of cyanate may be formed in the solutions. If this destruction of cyanide to cyanate can be prevented by the use of cheap cyanamide in presence of sulphocyanides, is it not a consummation devoutly to be desired?

To demonstrate that Mr. Mosher has not caught even a glimpse of the claims of my process, suffice it to insert a quotation from his article and leave the rest with the reader: "Unless Mr. Clancy has found some special effect on the use of cyanamide in his researches, I can only see a slight commercial value in its adoption in cyanide treatment."

JOHN COLLINS CLANCY.

New York, April 4, 1911.

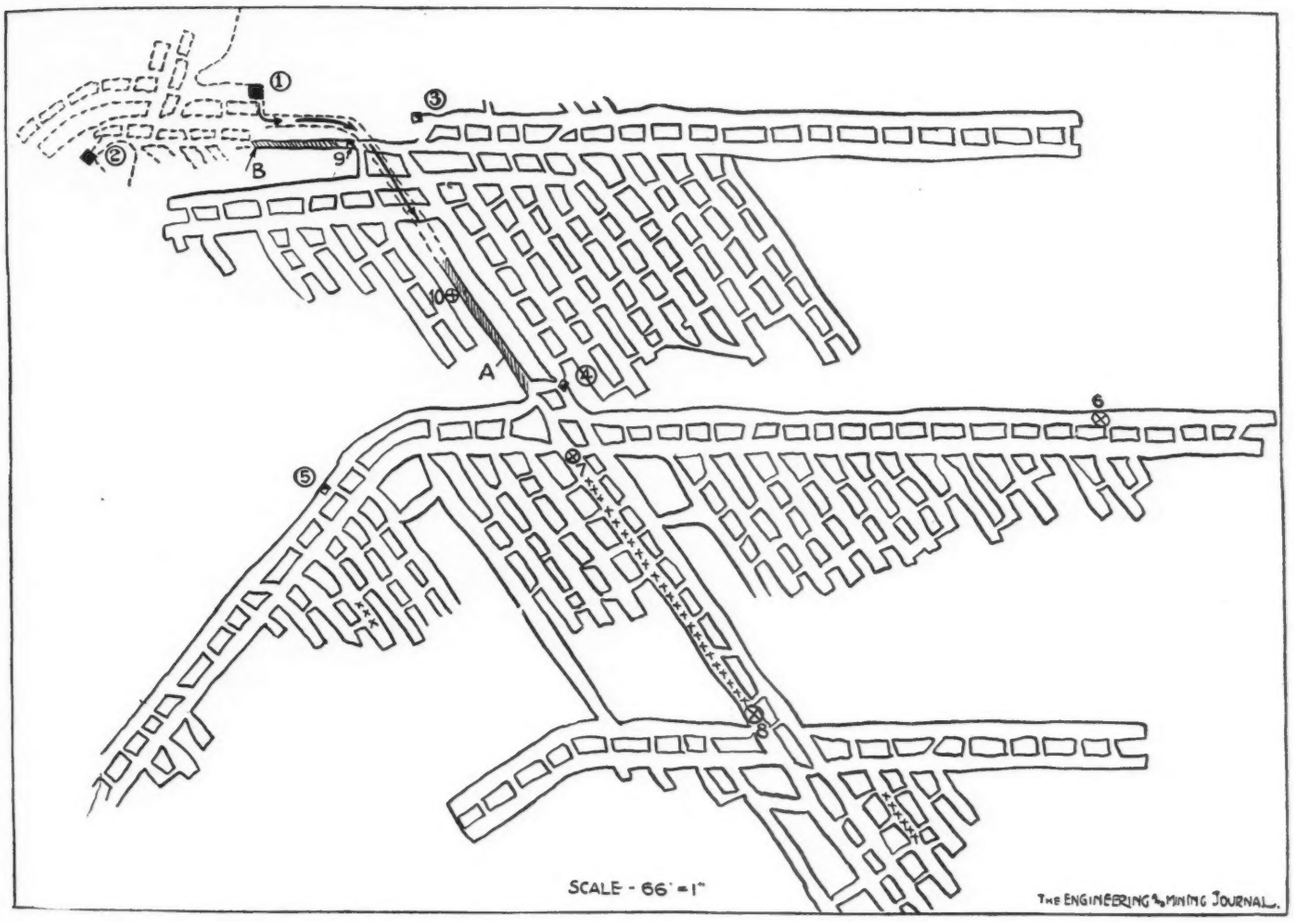
The Pancoast Mine Disaster

By Floyd W. Parsons

Through failure to realize the seriousness of what was at first only a small fire, 73 miners were suffocated at Throop, Penn.

A fire that broke out on a slope in the Pancoast colliery, at Throop, Penn., April 7, has resulted in the death of 73 men. The fire occurred in the Dunmore seam, 750 ft. below the surface. Suffocation caused the death of the men, and the evidence indicates that they smothered within an hour of the fire.

The accompanying sketch is a rough plan of the workings. The engine house which burned was located at the point marked 1; at 2 is the engine house which hoisted cars up the inclined plane *B* from the China seam. At 3, 4, 5 and 9 are shafts from the Dunmore bed to the China seam. The body of Evans was found at 6; Perry was found at 7, while Knight was found at 8, and Dawe at 10. At *A* is another plane connecting the Dunmore and the China seams. The smoke followed the direction indicated by the arrows and found an outlet up the airholes. The "*X's*" show where the dead miners were found, proving that the smoke had penetrated to the uttermost parts of this section of the mine. The engine houses 1 and 2 are in the Dunmore seam, the workings of which are indicated by the dotted part of the map. The slope or plane marked *B* leads from the Dunmore down to the China seam. As before stated, it is this *B* plane that the cars are hoisted up by the No. 2 engine.



MAP OF PANCOAST MINE, SHOWING WORKINGS IN THE CHINA SEAM AND SITUATION OF THE BURNED ENGINE HOUSE IN THE DUNMORE SEAM

The trip of cars which caught fire from the engine house stood where the first arrow opposite 1 is seen. Joseph Evans, whose body was found at 6, was foreman of the Government mine-rescue car, and died while trying to reach the entombed miners. Messrs. Perry, Knight and Dawe were mine officials who tried to warn the men of their danger and were themselves suffocated. Two miners escaped by turning in at the point marked *A* and working their way through an abandoned part of the mine. It is contended that many others could have saved themselves had they followed this same route.

SEVERE CRITICISM

As is always the case after such a disaster, criticism is rife and personal charges are made. I doubt if there is a coal mine in America that would come out clear if investigated tomorrow. We are making progress, but it is slow work, for the personal element cannot be eliminated, and there the greatest danger lies. An accident seldom occurs unless there is negligence or carelessness on the part of someone. It is so in this case, and the disaster appears to have been due largely to bad judgment in underestimating the importance of what was originally a small fire. Some critics censure the company because the engine sheds, situated more than 700 ft. below

the surface, were of wooden construction; these persons also point out that there was only one engineer to attend to the two engines 200 ft. apart.

There is no doubt but that the colliery was well equipped and that the officials had taken many precautions to fight a mine fire. Investigation shows that a good system of standpipes and hose was in use. The statement that the men were in a blind tunnel is not true; it is clearly shown on the accompanying sketch that there were ample exits from the China seam.

A report that a telephone message was sent into the mine ordering the men out seems to be verified by the fact that no dinner pails, lamps or coats were found in the chambers where the victims were working. If they had been warned first by smelling smoke, it is probable they would have dropped everything and rushed out.

Summing the matter up, the accident should not have happened for, first, the engine houses should not have been constructed of combustible material; second, the fire, if promptly attacked, would not have spread from the engine house to a trip of cars in the gangway, 30 ft. away. The delay in attending the fire was so great that fire apparatus in the building where the trouble started was rendered inaccessible.

The cause of the fire is still unknown. The engineer who attended both engine houses, found it on returning to the No. 1 engine house. An investigation is being made and the details will be published in a later issue of the JOURNAL.

New Lake Ore Steamers

The Shenango Steamship Company has let a contract to the Great Lakes Engineering Company, of Detroit, for two bulk freighters to be larger than any now afloat. They are to be 617 ft. over all, 64 ft. beam and 34 ft. deep, with a carrying capacity of 14,000 gross tons of ore on 19 ft. draft. The two steamers are to be 12 ft. longer, 4 ft. wider and 2 ft. deeper than any bulk freighter on the Lakes. Their engines are to be quadruple-expansion, with cylinders 23, 33, 48 and 69 in. diameter, with 42-in. stroke, supplied with steam from three Scotch boilers. They are to come out in 1912, and are to be built in anticipation of the completion of the third lock at the Sault, which will be 25 ft. deep.

Explosion at Alabama Mine

On April 8 a disastrous explosion occurred in the Banner mine of the Pratt Consolidated Coal Company in Alabama. It is stated that the explosion was caused by powder which set off a quantity of dust. The fatality list is estimated at 128. All but five of the miners were convicts, and only 20 were white men.

World's Copper Production

In the accompanying table we give the copper production of the world in 1910, as compiled by Henry R. Merton & Co., of London, who have issued similar reports for many years past. The estimates for 1908 and 1909 are also given, for purposes of comparison. The figures are in long tons.

COPPER PRODUCTION OF THE WORLD

	1908	1909	1910
United States	423,300	490,280	484,890
Mexico	39,990	56,325	58,825
Canada	28,570	24,105	25,715
Newfoundland	1,430	1,380	1,080
Cuba	3,000	2,960	3,475
North America	496,290	575,050	573,985
Argentina	225	600	300
Bolivia	2,500	2,000	2,500
Chile	38,315	35,785	35,235
Peru	15,000	16,000	18,305
South America	56,040	54,385	56,340
Austria	1,575	1,615	2,130
England	570	435	500
Germany	20,200	22,455	24,710
Hungary	2,240	4,600	4,955
Italy	2,975	2,725	3,220
Norway	9,190	9,080	10,425
Russia	20,085	17,750	22,310
Spain and Portugal	52,585	52,185	50,255
Sweden	2,000	2,000	2,000
Turkey	1,050	800	600
Europe	112,470	113,645	121,105
Japan	43,000	47,000	46,000
Africa	6,880	14,945	15,205
Australasia	39,500	34,400	40,315
Total	754,180	839,425	852,950

Of the Spanish production in 1910 the Rio Tinto furnished 33,575 tons. In Germany the Mansfeld is credited with 19,995 tons; in Norway the Sulitelma with 4925. In Africa the Cape Copper and the Namaqua are put down at 6905 tons, and 8300 tons are estimated as coming from other mines; most of this, probably, is the estimate for the Congo Free State.

The total estimated production in 1910 shows an increase of 13,525 tons, or 1.6 per cent., over 1909; and of 98,770 tons, or 13.1 per cent., over 1908. The production of 1910 was distributed as follows: United States, 56.5 per cent.; other North America, 10.5; South America, 6.6; Europe, 14.2; Japan, 5.5; Africa, 1.9; Australasia, 4.8 per cent. of the total.

Steel in Germany

The German Iron and Steel Union has completed the collection of statistics of the production of steel in Germany in 1910. That production was the largest ever reported, reaching a total of 13,698,638 metric tons, which was 1,635,006 tons more than in 1907, previously the year of greatest output. The details of the 1910 production are given in the accompanying table, in metric tons:

	Acid	Basic	Total	PerCt.
Converter ingots	171,108	8,030,571	8,201,679	59.9
Open-hearth ing	140,189	4,973,569	5,113,758	37.3
Direct castings	111,959	151,852	263,811	1.9
Crucible	83,202	.....	83,202	0.6
Electric	36,188	.....	36,188	0.3
Total	542,646	13,155,992	13,698,638	100.0
Total, 1909	564,802	11,485,032	12,049,834	.....

Direct castings are classified as acid and basic, but the statement does not give the quantities made from converter and open-hearth steel, respectively. The increase in converter ingots was 533,080 tons, or 6.9 per cent.; in open-hearth, 1,040,821 tons, or 25.5 per cent.; in direct castings, 57,355 tons, or 27.7 per cent.; in electric steel, 18,415 tons, or 104 per cent.; while in crucible steel there was a decrease of 865 tons, or 1 per cent. The total gain last year over 1909 was 1,648,804 tons, or 13.6 per cent. The proportion of steel to pig iron in 1910 was 92.6, against 93.3 in the previous year.

The production of steel in Germany and the United States in 1910 compares as follows, our make being reduced to metric tons, for purposes of comparisons:

	United States Tons	PerCt.	Germany Tons	PerCt.
Acid converter	9,563,376	36.1	171,108	1.3
Basic converter	.....	....	8,030,571	58.6
Acid open-hearth	1,231,575	4.6	140,189	1.0
Basic open-hearth	15,537,006	58.6	4,973,569	36.3
Direct castings	.....	....	263,811	1.9
Crucible	124,260	0.5	83,202	0.6
Electric	56,220	0.2	36,188	0.3
Total	26,512,437	100.0	13,698,638	100.0
Proportion steel to pig iron	95.6		92.6	

Of the United States make 41.4 per cent. was acid and 58.6 per cent. basic steel; while in Germany only 4 per cent. was acid and 96 per cent. basic steel. For the first time the proportion of steel to pig iron in the United States exceeded that in Germany. The high proportion of basic steel in Germany is, of course, due to the large supply of high-phosphorus ores there. A marked difference in practice is found in the use of the basic converter, in which 58.6 per cent. of the German steel was made; while in the United States it is not used.

Cripple Creek Mines

The usual yearly report of the Colorado Springs Mining Stock Association, dealing with the Cripple Creek mines, has just been issued. The report deals with the 75 Cripple Creek mines which maintain an organization and are listed on the Colorado Springs Mining Stock Exchange. The report shows that $15,878,000 in gold were mined during 1910 in Cripple Creek, the bulk of which came from above the present water level of the camp. It is estimated that the new Roosevelt tunnel will place a large tonnage in gold ores above the new water level, besides allowing the mining of much more by using some of the present pumping equipment. At present there is a flow of about 6000 gal. per min. from the tunnel portal. The low-grade milling processes will also open a new lease of life for Cripple Creek, Stratton's Independence and the Portland mill treating $3 ore at a profit.

The report gives a brief account of each company in the Cripple Creek district, showing officers, main office, capitalization, and other production and financial data, including high and low prices for the year of the various stocks.

Details of Practical Mining

This department is designed to treat in a brief way of details of everyday practice. Many readers are doing interesting things in mining and milling that other readers like to know about. The thought that there is nothing new in them should not be a deterrent of telling about them. Something that is an old story in one district may be quite unknown in another. Our draftsmen can develop any kind of pencil sketch that is intelligible. A blueprint answers all the purposes of the engraver. Contributions are solicited.

Notes of Interest to Prospectors and Operators of Small as well as Large Mines Things that have to be done in Everyday Mining

The Bryant Safety Crosshead

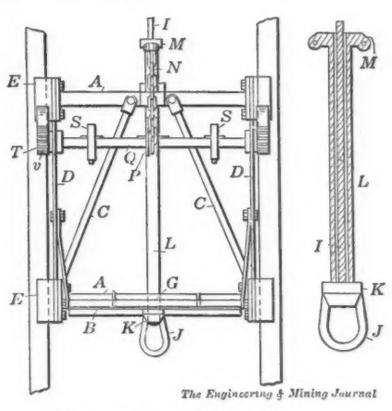
The accompanying illustration is of a safety crosshead for use in shaft sinking that has been patented by Thomas Bryant, of Butte, Mont. A crosshead of approximately this type was installed at the Original Consolidated mine in that district.

The frame of the crosshead comprises upper and lower cross bars *A*, platform *B*, braces *C* and side arms *D*, which are provided with guide shoes *E*. The cross bars are provided with the central passages *G*. The skip, cage, or bucket is secured to the rope, or cable by a shackle *J*, having a head *K* which normally engages the bottom of the lower cross bar. A tube or sheath *L* incloses the lower portion of the rope and is movably mounted on the cross bars in passages *G*. Normally this sheath rests upon and is supported by the head *K* of the shackle, but when the support is withdrawn, downward movement is limited by a collar *M*.

The upper part of the sheath projects a short distance above the upper cross bar and has chains *N* secured at the opposite sides of the collar *M*. Each chain is connected with a sheave *P* keyed to a shaft *Q*. One or more springs *S* are secured to each shaft so they will normally operate to wind the chains upon the sheaves. The dogs *T* are rigidly fastened to each shaft.

When the crosshead is operating in its usual manner it rests upon the shackle and moves up and down upon the guides with the rope. The sheath *L* is held in its raised position which pulls upon the chains *N* and holds the dogs *T* in their nonoperative position against the tension of the springs *S*. When the crosshead strikes any obstruction or sticks accidentally while the cable is descending, the rope with the carrier attached will continue its downward movement independently of the crosshead. The shackle disengages from the lower end of the sheath which thereupon drops by gravity and under the tension of the springs, into its lowermost position and simultaneously the springs rotate the shafts to bring the teeth on the dogs into engagement with the guides. The crosshead will thus be securely held until the bucket is raised again and the cable engages with and raises the tube, thereby rotating the shafts *Q* by means of the chains and returning the dogs to their nonoperative position.

By this construction the disasters caused by the falling of the crosshead upon the bucket, or after being accidentally caught on the guides will be effectually prevented. At the same time the cable is always free to move independently of the crosshead and if the crosshead should be caught no delay is occasioned as the cable can be lowered as far as desired and then when raised again the crosshead will be automatically released.



BRYANT SAFETY CROSSHEAD

In case the traction cable breaks it is obvious that the safety means will operate automatically in the same manner as when the crosshead is accidentally caught and will prevent the crosshead from falling to the bottom of the shaft.

The mechanism is especially adapted for use in shaft sinking in places where it is necessary to lower the bucket below the end of the guides, since a stop or other obstruction placed at the ends of the guides will cause the safety device to operate and hold the crosshead positively and independently while the bucket is lowered to the bottom.

Practical Demonstration of Loading Bore Holes

The charging and tamping of the holes drilled to break down coal or rock in a mine are matters of interest and importance, but too often these operations are poorly done due to negligence, carelessness of inexperience. It is impossible to see inside a drill hole that has been charged to determine if the fuse has been broken or kinked, the blasting cap pulled out of the cartridge or to discover the other possible causes of accidents that will occur to every practical man.

In order to enable the students in mining engineering at the University of Illinois to practise charging bore holes and then have the charge inspected and criticized, a charging box or "artificial hole" has been built. This is illustrated in a recent catalog of the E. I. du Pont de Nemours Powder Company, and consists of a block of timber 8 in. square and 4 ft. 6 in. long, with a hole 2 in. in diameter drilled in the center. This block is sawed through the center, hinged and held firmly by clamps while the hole is being charged. It is then opened and the charge easily inspected.

By varnishing and greasing the hole, the tamping is prevented from sticking to the wood when the top is raised. The "hole" is set on wooden horses and by raising one horse a bore hole inclined upward or downward can be obtained. Students are required to charge the hole, using different kinds of tamping, different explosives, and all of the ways of firing by squib, fuse and electric detonators. Sand or sawdust is used to represent black powder and dummy cartridges of inexplosive dope to represent the nitroglycerin explosives. The charge is examined and criticized by the class and by the instructor.

An experienced miner and former mine manager who was showing a class of students how to load the hole was much surprised to find upon opening the box that the fuse was kinked into an *S* shape and broken.

By the use of this box, the effect of using different kinds of tamping can be easily shown, the rate of burning of fuse in a hole can be tested and other experiments with explosives demonstrated much better than in the darkness of a mine where also the inside of the charged hole cannot be seen.

A glass tube was first thought of, but the glass breaks readily, is hard to clean for the tamping from another charge and moreover, as the inside can be seen during the tamping, the actual conditions are not represented nearly so well as with the block. The blasting box can be easily made and is adapted for demonstrating to inexperienced men at a mine the proper method of charging.

Arrangement of Economizers for Waste Heat Boilers

By N. L. Stewart*

The following suggestions are made for the arrangement of economizers for waste-heat boilers, to avoid the usual bad practice of using steam-driven auxiliaries in smeltery power plants.

By the use of economizers it is unnecessary to provide any other feed-water heaters and hence the boiler-feed and service pumps, the exhaust steam from which is usually used for feed-water heating, can be motor driven. Motor-driven pumps are more economical in operation and can be placed in any part of the plant and high-pressure pumps for converters, casting ladles, etc., should be near the apparatus they are to serve. The ordinary form of economizer would not be suitable as it would materially reduce the draft. I suggest a modified form with the tubes arranged as shown in the accompanying sketch. The tubes should be about 12 ft. long, which is longer than in the ordinary economizer.

Assume that a boiler of about 750 h.p. is installed but, only 500 h.p. developed. A total heating surface of 1416 sq.ft. would be obtained from 100 tubes 12 ft. long by 4½ in. outside diameter in the economizer. This divided by 500 gives 2.83 sq.ft. per boiler horsepower; this is low for direct-fired boilers, the usual practice being about 4.6 to 4.7 sq.ft. However, it would undoubtedly heat the feed water enough to relieve the boiler of any undue strain.

It may be said that economizer tubes 12 ft. long would require an excessively large flue connecting the boiler to the main flue; however, there are flues now in use as large as this. In the insert (Fig. 2) of the accompanying illustration is shown a section of the flues back of the boilers of furnaces Nos. 5 and 6 at the plant of the Garfield Smelting Company in Utah. Such flues are not expensive to construct. They can be built of red brick with at most only 4½ in. of firebrick lining. The distance from the back of the boiler to the main flue, for the above conditions, would only be about 40 ft., which is not excessive.

The usual automatic economizer soot cleaner could not be used here, but the tubes could be cleaned in the same manner as the boiler tubes. This is done by a jet of compressed air; the tubes at *A* are cleaned from the doors at *B* and *C*. As far as I know such an arrangement has never been used. At one plant a superheater is being tried back of the waste-heat boiler. It would seem that an economizer would be more desirable than a superheater. The engines would probably be provided with individual receiver separators to avoid trouble from wet steam.

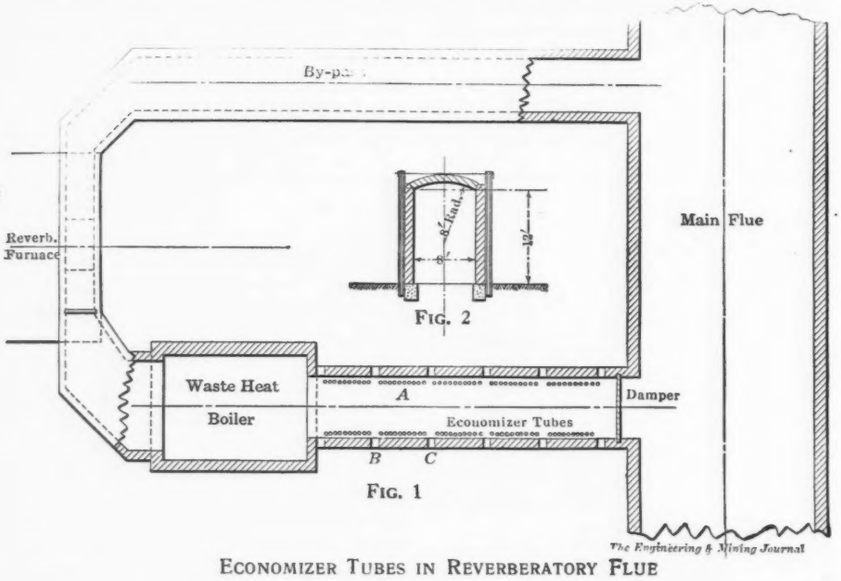


FIG. 1

FIG. 2

The Engineering & Mining Journal

ECONOMIZER TUBES IN REVERBERATORY FLUE

*429 Lovendale street, Salt Lake City, Utah.

The report on the Copper Queen smelting operations, at Douglas, Ariz., for the year 1910, allows the following comparison of flue-dust and bullion recovery to be made. The flue dust recovered amounted to 7.44 per cent. of the charge and the copper recovered in flue dust was 15.25 per cent. of the copper recovered in bullion; the silver in the flue dust was 13.3 per cent.; and the gold was 10.97 per cent. of that in the bullion.

Concrete Pipe Carrier

By Guy C. Stoltz*

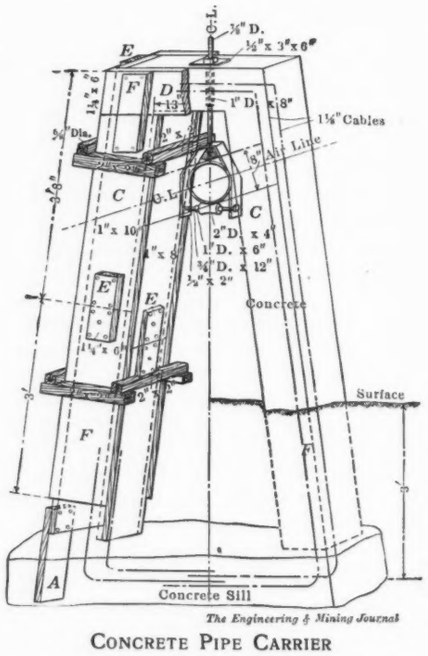
The accompanying drawing shows in detail a desirable method of hanging an air or steam line, when it is necessary to carry the line over an irregular topography and keep to an average gradient.

The bents are of monolithic concrete, 8x8 in. in section, and the legs have a batter of 1½ in. per ft. The whole is reinforced by two 1⅛-in. cables placed 4 in. apart and overlapping in the concrete sill. The forms are assembled as shown and raised to proper hight and level by nailing strips *A* to the bottom of the forms. The bent is braced in all directions by short guy lines from stakes driven in the ground.

After inserting the cables, which are held in position by wooden struts, filling can begin. When the sill has been poured, rocks or old bricks are placed around the bottom of the forms where the side boards are not long enough to hold the concrete in the legs. Before filling the cap a 1-in. pipe is introduced to receive a ⅞-in. bolt, to which is attached the pipe hanger *T*.

The U-hanger is made from ½x2-in. flat iron and tapped near the ends to receive a ¾-in. bolt on which is mounted the pipe roller. The latter is merely a concave spool casting around a piece of 1-in. pipe, 6 in. long.

Witherbee, Sherman & Co., at Mineville, N. Y., have recently hung an 8-in. air line in this manner, 3800 ft. long, consisting of 188 bents spaced at 20-ft. centers. These bents were from 3 to 20 ft. high. The average hight above the



The Engineering & Mining Journal

CONCRETE PIPE CARRIER

*Mining engineer and metallurgist, Mineville, N. Y.

surface was 4 ft. 10 in., and the average amount of concrete used per bent was 0.61 cu.yd. The cost per average bent was $5.90 and the cost per cu.yd. of material used in a bent was $9.67. For the foundations a 1:8 mixture was used, while for the bents a 1:6 mixture was employed.

Sixteen complete bent forms, having the dimensions given in the accompanying drawing, were used in erecting the 188 bents. The forms are easily removed by pulling off the nailing strips *E* and unbolting the 2x2-in. brackets. Strip *F* is not disturbed, for it is advisable to keep pieces *C* and *D* together to facilitate assembling and in order not to disturb the batter. H. Comstock, who is in charge of the power and plant at the Witherbee-Sherman mines, at Mineville, devised the style of carrier used.

Repairing Shaft Lining with Cement

By A. Breyre

An improvement on the Portier method of injecting cement behind cracks in iron or other shaft linings was evolved by Paul Goffart, at Maurage, Belgium, in 1909. Shaft No. 3 was sunk and lined with iron segments in 1881; on sinking shaft No. 4 in 1903-6, by the Kind-Chaudron process, at a distance of 40m. from No. 3, a crack about 2.5 m. long developed in the lining of the latter, at a depth of 210 m., and soon was yielding a flow of 830 cu.m. of water per 24 hours. The crack occurred parallel to and just above the lower flange of one of the segments. Owing to the rapid flow of water, the first attempts to close the crack, by injecting cement mixed with cinders, were failures. It became necessary then to find a substance, heavy, fine-grained and mobile, which could be injected at the same time as the cement and would form a resistant filter to hold the cement in place behind the broken segment. Lead shot, 00 size, or 2 mm. diameter, were selected, and were fed through a funnel into the descending column of cement grouting, which was injected through the lining just above the break. The method was entirely successful, and was then applied to other smaller cracks.

At the Hornu and Wasmes colliery, in Belgium, shaft No. 4 was lined with wood to a depth of 100 m., which had already been strengthened here and there by injecting cement behind it by the Portier system. As a means of replacing entirely the wooden lining, cementation was selected in preference to the freezing process, which would have occupied 10 months. Bore holes were drilled radially from the shaft to depths ranging up to 11.5 m., and cement was injected. The holes were located on two spirals, and additional holes were bored wherever the flow of water seemed to be the greatest. Altogether, 30 tons of cement were consumed. This work was done in holidays and other idle periods during 1906-8. A watertight bulkhead was put in the shaft at 117 m. depth, and the wooden lining was then removed in sections, beginning at the bottom; the lining higher up in the shaft was meanwhile supported by iron rods from the surface. As the wood was removed, masonry lining was put in its place, without any delay from inrushes of water. The cost of doing this work amounted to $252 per meter.

*One section of a general article on the sinking of shafts by special processes, in *Revue universelle des Mines*, May, 1910.

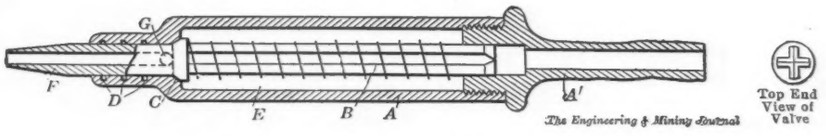
Oiler for Tramway Buckets

It is necessary to oil the wheels on the carriers on tramways, especially new ones, frequently. Moreover, the amount of oiling necessary seems to bear some relation to the roughness of the topography of the country across which the tramway is built. In the early stages of the life of a tramway two miles long, it is necessary to oil the buckets every trip, and later at least twice a day, while with tramways four miles long the bucket carriers have to be oiled at least every other trip. This oiling can be done at either end of the tramway, but generally it is far more convenient to do the oiling at the loading station, while the bucket is being loaded.

A tank of oil is placed at some convenient point above the loading-track station so that enough fall is given to the oil to insure a quick feeding of it to the carrier wheels. The oil is led through a small rubber tube to the metallic tip used for insertion into the oil holes on the wheels of the carrier carriage. To shut off the feed of oil, a spring clamp or pinch cock is generally used on the feed tube. Besides being inconvenient this is wasteful, for most of the oil in the tube below the point of clamping drops upon the timbers and the floor of the loading station while the tip is being transferred to the next oil hole. Moreover, as frequently the oil is not entirely shut off, by the time that the tip is removed from the hole some is almost sure to be spilled. This waste of oil is not only a source of needless expense, but it increases the danger from fire, and in time makes the loading station a greasy, sloppy, disagreeable place.

To obviate these objections, W. H. Cole, master mechanic at the Highland Boy mine, Bingham, Utah, devised the oiler shown in the accompanying drawing. The Cole oiler is attached to a feeding hose just as the tip is in the crude device commonly used. But in this oiler the oil cannot well be turned on until the oiler has been inserted to the bottom of the oiling hole, and the feed is shut off tne instant that the pressure is taken off the oiler. As a result there is no wasting of oil and the accompanying disagreeable features are eliminated. In addition, the oiling can be done quickly and easily.

The oiler is turned out of two pieces of brass *A* and *A'*, to form the shell, while the interior mechanism consists of a spring valve *B*, working upon a valve seat *C*. Leak about the valve is prevented by three oil rings *D*, in which no packing is used, as whatever oil may ooze down the valve rod forms its own natural packing at these grooves. The barrel is 1 in. in diameter, 4 in. long and the surface is milled to render it easy to grip. The surface of the piece *A'* that fits into the rubber hose is corrugated to aid in attaching the oiler securely to the feed hose. The valve has a play of ⅜ in., and the stem is fluted, the upper end of the stem being sharpened so as to assist the feed of the oil into the oil chamber *E*, when the valve is opened. The discharge hole in the valve tip *F* is bored to 5/32 in., connection with the oil chamber being through the hole *G*, bored at right angles to the discharge hole.



Nonleaking Oiler for Tramway Buckets

When the tip of the oiler is pressed against any resisting surface, as the bottom of the oil hole on the carrier wheels, the valve is forced back against the shoulder, and oil flows from the oil chamber in the oiler through the tip. When the pressure is removed, the spring forces the valve back on its seat and the transverse openings in the body of the valve are closed. This oiler can easily be made at a machine shop at small expense. It has been in use at the Highland Boy mine since the starting of the tramway which conveys the ore to the Tooele smeltery of the International company, and has been found to work admirably.

A 16-h.p. gasolene motor made by the Gas Motoren Fabrik Deutz is being tried for underground traction in the Langlaagte Deep mine, Transvaal. A special form of exhaust condenser is used, in which part of the cooling water is used to condense the products of the explosion, so that the vitiation of the air is stated to be less than would be the case if the many men required to deal with the load were at work.

Matte Explosions

By W. C. Smith*

The cause of explosions of molten matte when brought in contact with wet or damp surfaces has been an interesting subject to me for several years. Many say that the sudden generation of steam plays an important part; others claim that a rapid partial decomposition of matte due to superheated steam liberates large volumes of gas and this causes the explosion; and still others claim that both steam and gases are responsible.

The following are some of my observations: (a) In blowing in a lead blast furnace we use "mill cinder" (puddling-furnace slag), assaying 40 to 45 per cent. Fe and 30 to 33 per cent. SiO_2; CaO, none; Al_2O_3, none. When the furnace starts slagging the mill cinder comes through practically unchanged. This molten mill cinder has a marked tendency to explode on contact with damp surfaces. (b) Molten salt cake (Na_2SO_4) has to be handled with extreme care. A damp tool or slag pot will cause a violent explosion. (c) A copper-sodium matte carrying no iron is more dangerous to handle than ordinary mattes. (d) Molten caustic soda (NaOH), at high temperatures exhibits the same property. (e) Molten soda ash (Na_2CO_3), at high temperatures also requires care in handling. (f) Antimony litharge, consisting of PbO, Sb_2O_3, As_2O_3, and low in SiO_2, explodes violently, if it be at an orange heat.

My conclusions from these cases are: (1) The tendency of these materials to explode is not due to the decomposition of sulphides by steam since five of them contain no sulphides. (2) The presence of compounds of iron is not necessary, as five of them carry no iron. (3) Sodium or its compounds are not essential; for ordinary blast-furnace matte, mill cinder and antimony litharge are free from sodium. (4) No one element or compound is present in all materials under consideration, hence explosions are not due to any one element or compound. (5) One property possessed by all these materials when conditions are correct is great fluidity. Great fluidity means low viscosity and low cohesion. (6) A small quantity of matte from a settler was poured on a wet iron plate. The matte exploded violently, flying in all directions.

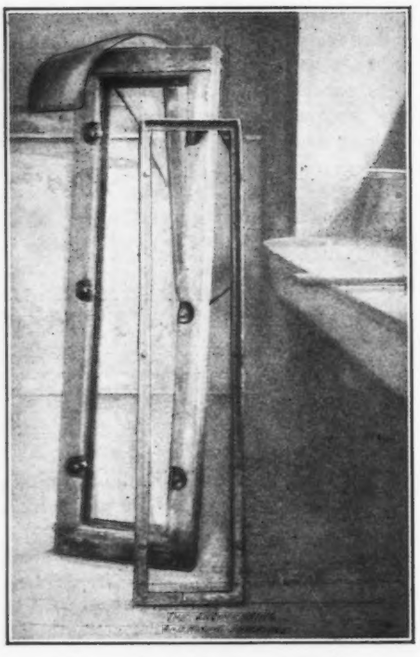
A small quantity of slag from the settler under same conditions did not explode but became pasty, blisters or bubbles rose to the surface, burst, emitted a jet of steam and the blister closed. The low cohesion of the matte allowed the steam to exert its force in scattering it, while in the case of slag the entire force of the steam was absorbed in overcoming the cohesion of the slag sufficiently to permit the steam to escape from blisters. Therefore, I believe that little or no decomposition takes place, but that the explosion is due to the instantaneous generation of steam and the low cohesion of matte.

*Metallurgist, Grasselli, Ind.

A Battery Screen Frame

The screens used in the batteries of the North Star mills, Grass Valley, Cal., are punched with round holes within squares of one inch on a side. Between each punched area and unpunched band of metal, ⅛ in. wide is left, as reinforcing. A tear, starting within the punched area, does not usually extend across the band. These screens have a life of 22 days as compared with 10 days for the usual type.

The screen frame is made of wood 2 in. square, the inner rectangle measuring 4 ft. 9 in. by the hight of the screen. To the back of the frame strips of 2x⅛-in. strap iron are screwed so as to extend ¾ in. into the inner rectangular space. The screen is held against the inner side of this strap-iron rim by a rectangular frame made of ¾-in. angle iron, the outside dimensions of which permit its fitting within the wooden frame. The angle-iron frame is held in place by six buttons. The construction is shown in the accompanying illustration.



North Star Battery Screen

At the Creston-Colorada mine, La Colorada, Sonora, it has been found economical to dovetail in flat bars of soft iron on the clutches for the aërial trams to take up the wear from the cable. The soft iron is beneficial to the cables and the bars can be easily and cheaply replaced.

Sampling Placer Ground

By Charles Janin*

The method advocated in the article on sampling placer ground in the issue of the Journal of March 25, of drying the panned residue from a sample, then blowing the black sand from the gold and weighing the gold, is not good practice. In the early days of dredging some engineers tried this method but soon discarded it for that followed by all experienced engineers, of amalgamating the gold after careful rocking and panning of the sample, dissolving the quicksilver from the amalgam with nitric acid and then drying and weighing the gold.

The statement that, when the distance to bedrock is 15 ft. or over, other methods than shafts should be used in prospecting gravel areas is not confirmed in practice. The difficulty of sinking shafts is not dependent upon depth alone but more upon the presence of a quantity of water or of running ground. I have sunk shafts in gravel 35 ft. and deeper without difficulty even when the water was present, and at less expense than drill-holes on the same ground. If the conditions are favorable for shaft sinking, then that method is, of course, preferable, but drill holes, like shafts when properly placed and carefully sunk, will indicate the value of the ground within a close degree of accuracy. However, unless the work has been carefully done in every detail the average results obtained might be far from representing the value of the ground under examination and experienced judgment is needed in every phase of the work.

The determination of the value of placer ground by making a composite sample of all the samples obtained from a property, panning this so called "average" and calculating the average value of the ground in one fell swoop, cannot be too severely condemned. The inadvisability of such practice, I should think, would be strikingly apparent. The placing of holes in prospecting gravel areas is an important feature and preliminary holes or shafts determine whether the gold occurs in channels or is more or less evenly distributed. To mix the results from these holes in such a nonsensical manner as that described would be to lose the benefit of any information that might be gained from the samples and it is obvious that the result obtained from such practice would be inaccurate in the highest degree and not of the slightest value.

It is such methods as these that may occasionally account for the wide discrepancies between the average value claimed from prospecting and the recovery when afterward working the ground.

*Mining engineer, Kohl building, San Francisco, Cal.

Anaconda Company's Timber Treating Plant

The Anaconda Copper Mining Company has recently started its wood-preserving plant at Rocker, near Butte, Mont. The site is an area of about 200x800 ft., on the main lines of the Northern Pacific; Chicago, Milwaukee & Puget Sound; Butte, Anaconda & Pacific railways; and a branch of the Oregon Short Line. The plant was built in co-operation with the United States Forestry Service.

Next to checking the waste by forest fires, wood preservation through chemical treatment is, perhaps, the most important phase of forest conservation. Not only does the preservative treatment of timber bring about a direct saving to the individual timber user, but the general adoption of such measures means a great saving to the timber resources of the nation as a whole. At the present rate of consumption, the exhaustion of the supply of the better class of structural timbers in the United States is a thing of the near future.

The plant at Rocker is conveniently arranged and suitable for treating wood by the various processes. Coal-tar creosote is used as a preservative, being received in tank-car lots. The treating cylinder, 6 ft. in diameter and 43 ft. long, is built to withstand a working pressure of 100 lb. and has a capacity of 530 cu.ft., or 6360 ft. board measure, per run. It is planned to treat all the ties and bridge stringers for the Butte, Anaconda & Pacific Railway, shaft sets and timber in permanent openings of the company's mining properties in Butte and vicinity. Steam, electric power, etc., are furnished from the boiler and engine room of an old framing mill about 400 ft. distant, where all stope timber is framed. A tank for the butt treatment of poles is installed. Lodgepole pine given a butt treatment with creosote will last 18 to 22 years, as compared to 8 to 13 years for untreated cedar.

An accompanying table shows approximately the relative cost of untreated cedar and treated lodgepole pine poles, f.o.b. Butte. It is seen that in every case the treated lodgepole pine will cost less than the untreated cedar.

COST OF TREATED PINE AND UNTREATED CEDAR.

Length	Top diam.	Cost Untreated cedar	Cost Treated pine
25	6	2.10	1.85
25	7	2.45	2.16
30	6	2.65	2.37
30	7	3.20	2.80
30	8	4.20	4.00
35	6	3.85	3.00
35	7	4.75	3.60

The following shows the estimated saving by using treated timber in mines.

The cost of one complete set of untreated timber erected in a main drift or cross cut is $20.77; the cost of a similar treated set, $28.02; estimated length of life of the untreated timber, 6 years; estimated length of life of the treated timber, 20 years.

Figuring on 5 per cent. compound interest, the annual charge for the untreated set would be $4.09, as compared to $2.38 for the treated, thereby an annual saving of $1.71 per set is obtained by using treated timber. However, in considering the practice of wood preservation, the initial cost of the timber should not only be considered, but also the labor cost of replacing decayed material and the gradual increase in price of all kinds of lumber. The treating plant at Rocker was designed and installed under the supervision of a Forest Service engineer.

Iron Silver Mining Company

In the report of operations for the year 1910, of the Iron Silver Mining Company, operating mines at Leadville, Colo., George O. Argall, the general manager, calls attention to the possibilities of profitably mining the zinc-carbonate ores, the extent and value of which have been but lately recognized.

The search for the carbonate ores has been conducted principally from the Tucson shaft, and such ores are now being shipped from previously abandoned and supposedly "worked-out" stopes. The sulphide ores are gradually being exhausted and a large amount of development work has not materially increased the ore reserves; to which condition is due the constant decrease of production of late years. The discovery of the oxidized ores comes at an opportune time, for they, no doubt, will make it possible to maintain or perhaps increase the present production.

During the last year four dividends of $50,000 each were paid. The total ore shipped was 58,863 tons of an average net value of $6.62, the cost of producing which was $4.43. The total net income from ore sales and sundry revenue was $398,884 and the excess of income over operating expense was $142,669. For new equipment $4360 was spent, which left $138,308 to be added to the surplus from 1909 of $329,342. After payment of the four dividends a surplus of $267,650 remains.

Utah Consolidated

The report of the Utah Consolidated Mining Company for the year ended Dec. 31, 1910, was discounted by the information already made public concerning its ore reserves on Dec. 1, 1910. The ore reserves are estimated at 381,000 tons, averaging 2.44 per cent. copper; 0.63 oz. silver, and 0.05 oz. gold per ton, about two years' supply under the present shipping rate. During the last year $118,709 was expended on exploration and development, a sum larger than in any previous year.

While the area to the west of the former mine workings gave no favorable returns, and explorations in the present area and to the north thereof in the upper level showed only small orebodies, on the lowest level of the mine a body of ore averaging 4½ per cent. of copper has been opened. The average recovery per ton of ore shipped during the last year was 40.5 lb. Cu; 0.83 oz. Ag; 0.0805 oz. Au.

The total profit for the year was $65,349, and the total profit and loss balance is $322,239. Smelting and aërial tramway (to the Tooele smeltery) costs were $2.88 per ton of ore mined; smelting expenses were $3.33 per ton of material smelted. The total income for the year was $1,253,715, a decrease of $512,948 compared with 1909. While it is true that after paying the $150,000 dividend there is a deficit shown of $84,651, the dividends were declared in 1909. Since its incorporation dividends have been declared amounting to $8,600,000, or 573 per cent. on the authorized capitalization, and the company still has an excess of $943,342 of liquid assets over liabilities.

Abangarez Annual Report

The fourth annual report of the Abangarez Gold Fields of Costa Rica states that during the year ended Dec. 31, 1910, there was mined and milled 31,317 tons of ore, of an average value of $25.71 per ton that yielded $805,234. The cost of operation was $532,684, leaving a balance of $272,550. The cost of operation includes maintenance and $82,363 spent in developing the mine.

The property of the company is situated on the Pacific slope of the mountain range, about 18 miles from the Gulf of Nicoya in the district of Las Cañas, province of Guanacaste.

The main mill comprises 40 stamps weighing 850 lb. supplemented by two 54-in. by 20-in. Gates tube mills. All the ore is slimed, agitated in cyanide solution and filter pressed. The mill is so planned that the method of treatment may be varied when a special process is deemed necessary by the management.

Power is furnished by electrical transmission, generated by water power supplemented by steam, pending the completion in the near future of a large hydroelectric installation designed to provide for a much larger development of the region controlled by the company.

There is a subsidiary plant known as the "Boston mill" to treat ores not hitherto accessible for treatment at the main plant. This mill comprises 20 stamps (10 of 850 lb. and 10 of 950 lb.) and the product is classified into sand and slime; the sand is leached in vats; the slime is sent through a pipe line to the lower filter-press plant in the main camp.

During the last year $60,000 was paid in dividends on the outstanding preferred shares, 40,000 at par value of $25, all of which have been issued. The common stock is 160,000 shares of a par value of $25, of which 152,000 have been issued. Additions and improvements to mill plants cost $10,677, electrical power installation $266,689, new tramways $109,776, buildings and furnishings $34,859, mine and other machinery $21,625, and a new wharf at Manzanillo $8772, a total of $452,398 spent in improvements.

The development of the property has been conducted under the supervision of Percy L. Fearn and the ore blocked out is at present in excess of the quantity of ore in sight at any previous time in the history of the company.

Standardizing Mine Accounts

The council of the Institution of Mining and Metallurgy has unanimously adopted the report of the mine-accounts and cost-sheet committee, recommending that its grouping of expenditures upon mines be adhered to as far as circumstances may permit. The dissimilarity of conditions in mines renders uniformity in accounts impracticable; nevertheless the conclusion of the committee is that certain general principles may be laid down which will facilitate a comparison of costs at different mines. The recommendations of the committee are given briefly below.

Capital Account

Before the producing stage is reached all expenditures should be charged to capital account and may be grouped under the following head: (1) Property; (2) main shafts or main adits; (3) machinery and plant; (4) building; (5) surface work (reservoirs, water service, railroad, roads, etc.); (6) underground development. Main shafts or adits to reach orebodies should be charged direct to capital. Inclined shafts that develop ore, subsidiary shafts, winzes or other workings that have assisted development of ore during progress should be charged to underground development, which may be subsequently treated as a temporary development account, or may remain a capital charge.

After the producing stage is reached no expenditure should be charged to capital account except large special items, such as: (1) Purchase of additional property; (2) sinking of new main shafts to reach orebodies; (3) erection of additional buildings, machinery, plant or surface works which may be necessary either to increase output, to improve recovery or to decrease costs. Such items of capital expenditure should bear their proportion of the administration and general charges. If any existing shafts, machinery, plant or buildings should be entirely superseded and replaced, the cost of the old items should be written off capital to profit and loss, either at once (if small), or in the case of large items by instalments spread over as short a period as the responsible engineer may recommend. All repairs, maintenance and replacements of minor machinery and plant should be charged to working costs.

In the interest of shareholders, the committee expressed its strong disapproval of the practice, sometimes resorted to, of charging to capital items of expenditure that should properly be included in workings costs, thus exhibiting a fictitious statement of profit.

Profit and Loss Account

Development—After the producing stage is reached, all deepening of main shafts after they have reached the orebody, sinking of interior shafts, as well as all driving, crosscutting, raising, winze sinking and plat cutting, should be charged to the development account, which may be treated either as a main head of working costs, or the whole of the development before and after reaching the producing stage may be treated as a temporary account. In the latter case the working account should be debited with an average rate of development redemption slightly in excess of the average cost at which the payable ore reserves have been developed, reckoned on a milling basis; with the object of gradually extinguishing the temporary account, or of providing funds for securing a gradual and automatic increase in the ore reserves. After such temporary account is extinguished all development should be charged direct to working costs.

Temporary or distribution accounts—With the object of distributing costs as evenly as possible, it may be desirable to open other temporary accounts in order to spread the cost of considerable items of machinery or plant replacement, or payments which recur annually or at somewhat long intervals, over the monthly costs; the multiplication of such accounts is, however, undesirable, and they should be rigorously extinguished.

Valuations for balance sheet and profit and loss account—Bullion, concentrates or other marketable products ready for shipment should be shown as assets in the balance sheet and credited to revenue account at net valuation after deducting all possible realization charges. Unfinished products when taken into account should be reckoned only at cost, provided such cost does not exceed market value.

Depreciation

Depreciation may be considered as it affects the principal heads of capital expenditure, viz.: (1) Property; (2) main shafts or adits; (3) machinery, plant, buildings and surface works. As regards property, systematic depreciation is theoretically correct, and especially so in the case of mines with orebodies of limited and definitely determinable extent but is seldom or never carried out. In such cases, however, special reserve funds may be accumulated out of revenue with the full knowledge and assent of the shareholders.

In the case of some mines, the probability that existing main shafts will sooner or later be required to be superseded by new ones is so great that it becomes desirable to write down gradually and systematically the cost of existing main shafts, or to accumulate otherwise an equivalent cash reserve sufficient to cover the cost of a new shaft when required.

As regards machinery, plant, buildings and surface plant, it is clear that although maintained out of revenue in perfect repair and efficiency all such items are liable to become obsolete and have to be superseded. The committee was, therefore, of the opinion that suitable financial provision should be made gradually out of revenue in the case of every mine for new machinery and plant, buildings and surface works, all of which will probably be needed before the mine is worked out.

*Bull. No. 76, I. M. M.

California Oil Production

The production of crude petroleum in all fields for February, in excess of fuel consumption in operation, was 5,339,720 bbl., a net decrease from January production, of 652,632, the total for January being 5,992,352. There were gains in four of the thirteen fields: Midway 2435 bbl. daily increase; Santa Maria 1576; Los Angeles, 873; Whittier, 136. The greatest daily decrease was in Fullerton-Puente, 3732 bbl; Coalinga, 3234. In the month there were 915 wells drilling, and 72 completed. The producing wells numbered 5030 active; 646 idle. The oil fuel consumption in the fields totaled 365,500 bbl. There was an increase in stocks during February of 865,000 barrels.

Lead in Colorado

The production of lead in Colorado in 1910, as compared with 1909, is officially reported, in tons of 2000 lb., by the State Bureau of Mines as follows:

County.	1909.	1910.
Clear Creek	1,495	1,228
Hinsdale	50	124
Lake	7,061	6,364
Mineral	4,526	4,065
Ouray	1,354	2,022
Pitkin	6,315	6,704
San Juan	4,921	5,444
Others	6,638	9,331
Totals	32,360	35,282

Lake county is substantially Leadville; Mineral, Creede; Pitkin, Aspen. The lead entered under "other counties" was derived from San Miguel and Summit counties.

Ore Occurrence at the Dome Mine

By P. B. McDonald *

Gold occurs in quartz masses and veins in Huronian sediments and Keewatin schists. Some of the gold is visible but most of it is disseminated, principally through the quartz, although it also occurs in the country rock.

*Mining engineer, Iron River, Mich.

One of the most interesting features of the Porcupine gold district is the remarkable dome-shaped outcrop of gold-bearing quartz at the Dome mine, about two miles southwest of Porcupine lake. Visiting mining engineers have remarked at the rounded mound of rock, which, rising out of the swamp, reveals two great masses of quartz, each 110 ft. in diameter. It was at this property that the original discovery of gold at Porcupine was made by "Jack" Wilson, of Marquette, Mich., and throughout the development of the district, the "Dome" ranked as one of the two or three most promising properties.

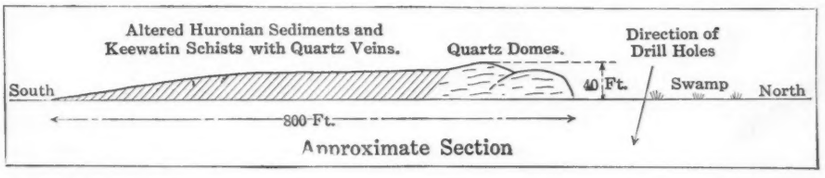
The peculiar form of the quartz, that in most other cases is confined to veins and stringers, has an important bearing, not only from the geological point of view, but upon the economic value of the property. For it is evident that an ore-body which, in lateral dimensions, is roughly 700 by 250 ft., can be mined much more cheaply than the ordinary narrow vein. As a matter of fact, it is planned to underhand stope the Dome ore, according to the well known glory-hole method, at a cost that threatens to rival some of the records made in the extraction of iron ore in the Lake Superior district. In this manner ore of a lower grade can be mined than at most of the other properties of the Porcupine camp.

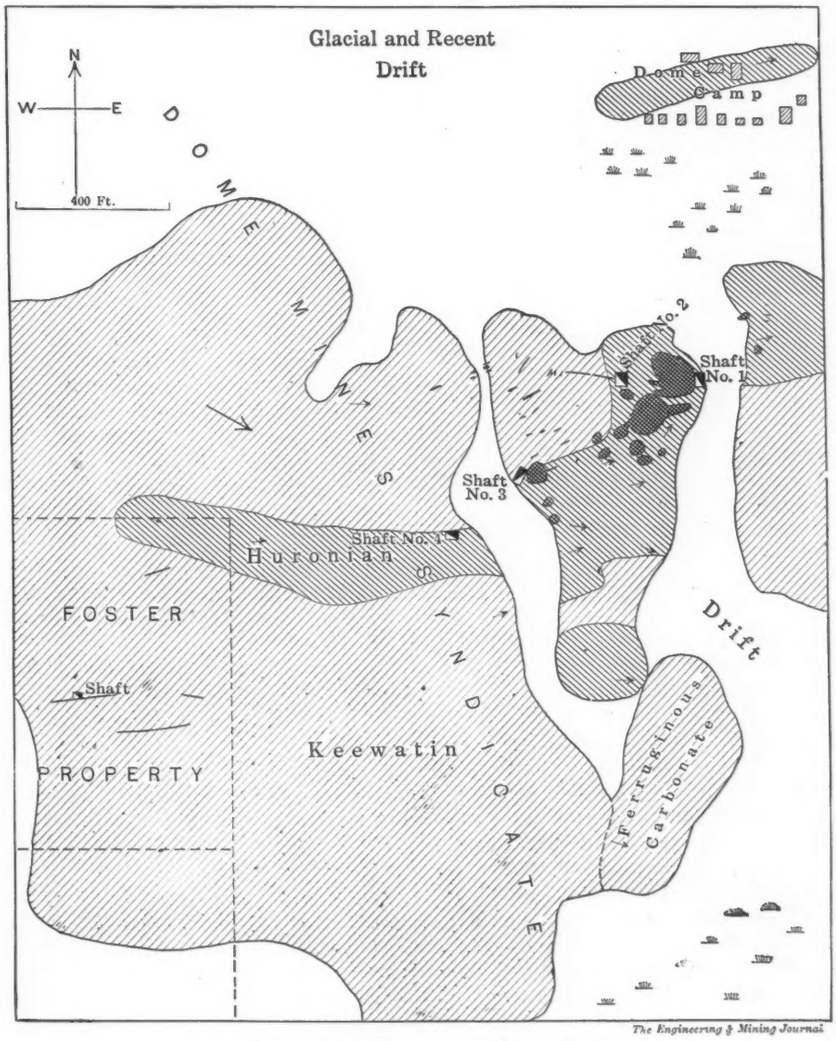
Geology

The outcrop is composed of quartz masses and veins in Huronian sediments and Keewatin schists. The sediments include dark-colored graywackes and slate, and a conglomerate composed of flattened gray pebbles drawn out in the direction of the lamination of the schist. The Keewatin schists are dull, greenish rocks containing, especially near the contact with quartz, bright perfect crystals of pyrite that are supposed to have been formed on the occasion of the last period of metamorphism to which the region was subjected. The quartz is white or glassy, a little stained with iron, and contains frequent intrusions of country rock; it is in the vicinity of these intrusions that the gold occurs in the largest quantity.

There are two major masses of the quartz that show most markedly, and it has been the white, glistening domes that visitors have remembered in connection with the Dome mine. These two mounds, with but a narrow strip of country rock between them, reveal practically a solid expanse of quartz 220 ft. long and 100 ft. wide. In the same general direction, to the northeast and southwest, occur smaller masses and veins of quartz both in the Huronian and Keewatin. The provincial geologist's report states that the age of the rock does not have any bearing upon the form or gold content of the quartz. As a rule, the veins strike east and west, coinciding approximately with the strike of the country rock (unlike the occurrences at the Hollinger mine, four miles to the west, where the veins cut across the strike of the schist).

Free gold is visible at a number of places on the outcrop, but one not familiar with the property does not distinguish the finely disseminated particles offhand. The yellow metal is found principally in the quartz, but also occurs in the country rock. During the sampling of the outcrops a number of exceptionally rich specimens were picked up, although con-





GEOLOGICAL MAP OF THE DOME MINE

Quartz outcrops are cross hatched; veins shown as black lines.

centration of gold by dissolving the gangue has not been marked, because of the shallow zone of oxidation that characterizes the entire district. For this reason sulphides, of which iron pyrites is the most common, occur almost at the surface. In explanation of the shallow zone of decomposition, it is said that the glaciers scraped off a great thickness of this ancient land mass, so that the rock now exposed represents the one-time "roots of mountains."

Persistence in Depth

The problems which confronted the Dome Mines company, when it took over the Wilson claims, were unique. There was a great outcrop showing free gold in remarkable quantity. But was the quartz mass shaped like an inverted cone that pinched out just below the surface, or, if it continued, did the gold content persist at depth? Also did the large masses dip to the north, as most of the small veins do? To answer these questions and to sample the orebody systematically, H. C. Anchor, of California, was engaged, and a force of a hundred men was put to work. Mining machinery was hurried in 35 miles from the railroad before the spring break-up rendered the swamps impassable.

Three shafts were sunk for a 50-ft. lift, and a system of drifts and crosscuts was driven at regular intervals; no effort was made to follow the high-grade streaks that were occasionally found. In this manner about 1000 ft. of underground work was completed, and an average assay value obtained for each 5 ft. of drift. Two scoopfuls were taken from every bucket of ore hoisted, to be reduced for fire assay, while a sample mill, consisting of a Nissen stamp, amalgamation plate and a Deister table, was operated. In addition several diamond-drill holes were put down in the swamp at an angle that it was figured would intersect the formation 400 ft. below the surface. Gold in paying quantities was found at that depth.

Quantity of Ore Developed

The proved orebody so far determined stands in a general northeast direction from shaft No. 3 to shaft No. 1 and is roughly elliptical in plan. Shaft No. 4 was stopped in rich ore at a depth of 30 ft. The management estimates to date that there is blocked out ore to the value of $7,000,000, at an average assay value of $10 per ton. The underground developments were temporarily suspended when sufficient ore had been proved to warrant the installation of a stamp mill, and the company expects to find continuations of the orebody upon resuming operations with an uptodate equipment.

The peculiar occurrence of quartz in such a large mass has been the subject of much discussion. One of the most widely accepted theories of its formation has been advanced by George O. Randolph, mining geologist, of Porcupine, and is as follows: The dome, or mass, was originally a quartz vein. When intense compression brought about the general metamorphic condition in the region, the soft, pliable schists and sediments were buckled and foided into smaller space. The harder, more brittle quartz would not bend, but was sheared and pushed into the masses, which now form the nucleus of the Dome orebody. A somewhat similar case has been observed in the Lake Superior iron country, near Negaunee, Mich., where broken masses of quartzite are surrounded by folded slate.

Mines Company of America

The report of the Mines Company of America for the year ended Dec. 31, 1910, shows that in the year under review the company purchased 94 per cent. of the capital stock of the Dolores Mines Company, and 96 per cent. of the stock of El Rayo Mines Company, and in conjunction with these companies has purchased La Dura Mill and Mining Company. The company already owned the entire stock of the Creston-Colorada Company. The Mines Company received dividends in 1910 on its Creston-Colorada stock amounting to $225,000, and miscellaneous earnings of $1456, had miscellaneous expenses of $14,640, paid dividends of $180,000 (9 per cent. on its old capitalization of $2,000,000) and carried forward $31,817 to surplus. At Dec. 31, 1910, the accumulated surplus stood at $159,652, of which $25,571 was in cash.

The Dolores Mines Company holdings consist of 250 acres in Dolores, Chihuahua, and 163 acres a few miles away, besides certain timber concessions. Good ore developments were made here in 1910 and on Jan. 1, 1911, the ore reserves were estimated at 64,759 tons in the mine valued at $26.45 per ton, and 15,000 tons on the dumps valued at $10.80 per ton, based on silver at 50c. per oz., and $20 per oz. for gold. Working costs are now $12.60 per ton and the extraction is 90 to 92 per cent.

El Rayo Mines Company owns 766 acres in the Santa Barbara district, Chihuahua, Mexico, in which it is estimated that ore blocked out on Jan. 1, 1911, was equal to 53,100 tons at $16.74 per ton, or $889,300 total. The operating costs have gone steadily down at the mill in late years, falling from $10.21 per ton in 1908 to $6.23 per ton in 1910.

The Creston-Colorada Company owns 362 acres of mining claims, and 7000 acres of surface ground at Minas Prietas, Sonora. Estimated ore reserves are 284,310 tons of ore at $6 per ton and 9000 tons of slime at $5 per ton, a total of $1,750,860. The working costs for the year ended Oct. 1, 1910 were $4.74 per ton, but it is hoped to reduce these to $3.80 for 1911. The company has leased the Chas. Butters & Co., mill and cyanide plant and began operations there March 1, 1911. During the fiscal year 107,500 tons of ore were mined, or 276 tons per man per year. La Dura properties consist of 563 acres of mining claims and surface rights to 16,520 acres, on the Yaqui river, at La Dura, Sonora, Mexico, on which there are two developed mines, Gloria and Prieta. It is estimated that in both these mines there are 27,500 tons of ore blocked out, with a gross value of $1,108,060. The former owners of these properties paid dividends of almost $2,000,000, besides equipping the properties out of the profits.

It appears from the separate balance and income sheets that all of these properties have good surpluses, and are steadily paying dividends and setting aside proper depreciation charges. In 1911 the Mines Company of America will share in these earnings.

The Belmont Mine Fire

At about 6 a.m., Feb. 23, the occurrence of a fire in the mine of the Tonopah-Belmont Development Company was reported to the hoist engineer at the East Belmont shaft. At the coroner's inquest, the following facts were brought out: About seven o'clock the general superintendent, mine superintendent and master mechanic reached the point on the 1166-ft. level where the fire originated and where they found it burning in about 75 pieces of mine timber. It was decided to attempt closing the draft that was fanning the flames by building a bulkhead, and men were sent to the surface to obtain material and chemical fire extinguishers. Shortly after, the general superintendent left the place and, so far as is known, was the last man to leave that portion of the mine alive. He climbed the winze to the 1100-ft. level and arrived there in an exhausted condition. He found a number of men at the 1100-ft. station and with them ascended to the surface, by which time dense clouds of smoke were pouring from the collar of the Belmont shaft.

At a point 60 or 70 ft. above the 1000-ft. level the cage stuck for a moment, and later four bodies were found in the bottom of the shaft. It was concluded that one or more of the men fainted and that their bodies were brushed off the ascending cage.

The fire did not continue long, but 17 men were killed. The coroner in his report states that the fire was not considered particularly serious up to the time the last men reached the surface from that part of the mine, and that lack of knowledge and experience in such an emergency were responsible for the inability of the management and bosses to realize the impending danger.

The Orijarvi Mine, Finland

By Dwight E. Woodbridge *

A description of a mine worked 150 years ago by quaint, primitive methods; has produced 9,000,000 lb. of copper and is now operated by an American company that will treat the copper-zinc ore by a flotation process.

*Mining engineer, Sellwood building, Duluth, Minn.

At the mine of the Finnish-American Mining Company, on the Fiskars Estate, Orijarvi, Finland, is now being installed, a plant for the separation of zinc and copper by the flotation process of the Minerals Separation Company, Ltd. The separator building, an illustration of which is given herewith, is 125 by 160 ft., and was erected with concrete foundations and floors throughout.

That construction work is not so slow on the other side is shown in the fact that ground was broken for this mill August 6, last. Most of the machinery is now in place, and production has probably already begun.

The mine is situated in Kisko parish, province of Abo, about 18 English miles from a good harbor on the Gulf of Finland, and 10 miles over a surveyed route to a connection with the Finnish state railways connecting Helsingfors and Turku. It is in a region of good public roads, of high cultivation and moderate climate, though the summers are so short that every parish contains a stone warehouse, capable of holding sufficient seed grain to sow all the parish fields should the year not produce a matured and ripened crop. Geologically, topographically and arboreally the region resembles northern Minnesota. As it is 15 deg. further north its season is much shorter, and its sunlight, during the summer solstice, running up to 20 and 22 hours per day.

A Complex Ore

The Orijarvi produces an ore rather difficult to treat, consisting of chalcopyrite, pyrrhotite, sphalerite, and some galena, all slightly auriferous and argentiferous. The rocks are highly silicious. When the mine was originally worked, from 1757 to 1875, nothing but the copper could be handled, and there are now on the surface great piles of zinc sulphide ore of all grades. A careful examination of these piles indicates that there are at least 1000 tons of 30 per cent. zinc, 6500 tons of 20 per cent. and many thousand tons of ore that will average 5 to 6 per cent. This higher-grade ore was long ago separated from the waste and copper ores and piled by itself, while the lower grade will be recovered only by concentrating a large tonnage of rock. As the mineral coveted by the early miners was copper, these piles contain little of it, cobbing evidently having been quite closely and carefully done at a low scale of wages. Indeed, the natural separation of these two minerals has been very good, for the mine shows large stopes of zinc practically free from copper, and others of copper with comparatively little zinc.

Under the method now being installed it is intended to sort the run-of-mine ore, then after crushing and classification, the 40-mesh product will go to Wilfleys, while the oversize will be reground and concentrated on tables. The slimes and undersize will then be treated by the Minerals Separation process, which has been found to work effectively on these ores.

Flotation Process Mill at Orijarvi, Finland

Ore May Be of Secondary Origin

The ore deposits of Orijarvi occur in the northern limb of a great anticline and dip downward on the north. Granite is the foot-wall, diorite the hanging. It is presumed by Tigerstedt, of *Finska Geologiska Kommissionen*, that this ore is "secondary," that is, of later origin than the surrounding rocks, and under the influence of the diorite outburst that stretched along to the northward of the main ore-bearing formation. If this be the case, the ore can be regarded as persisting in depth. On the other hand, it is feared by Doctor Sederholm, chief of the Finnish Geological Survey, that the diorite and granite pinch out the ore at greater depth, and it is quite possible that his view will prove correct, though at such depth that there will be a workable deposit above the pinch. At the time of my examination of the mine, and prior to the beginning of operations preliminary to ore production, the greatest depth reached was about 300 ft.; today the mine has been developed on the 400- and 500-ft. levels. There is a somewhat barren zone at the 400, but the lower level is looking especially well.

The vein, which was found much broken and distorted on the upper levels from the intensity of eruptive action, is now somewhat more regular, while the zinc, massive blackjack, seems to be cutting out with depth. Diamond-drill work from the bottom levels is in progress. In the early days the Finnish government conducted drill work under the charge of its geological department, and located some bodies of ore beneath what was then the bottom of the mine.

Early Methods of Mining

Historically, this old mine has a peculiar interest. It was first opened in 1757 and was operated uninterruptedly for 118 years, when the settlement of large estates, deaths and diverse outside interests combined to close it. The workings filled with water and remained filled for many years. Some are even now full of water. One or two attempts toward reopening were made subsequent to 1870, but by men with limited capital and experience, and these all failed. In 1906 an American company, composed almost entirely of men from the Michigan copper region, largely Finns, acquired the properties, and have been working them ever since.

Mining in Finland in the early days was not done with the ability that was then manifested in other parts of the world, and this is strange, for its parent country, Sweden, was then to the front in mining science. But this work was then, as it has been since, a very minor industry in Finland. At Orijarvi the miners had no powder for blasting and only makeshifts for lighting purposes. Their knowledge of mining was limited to their own experience, consequently peculiar situations arose. These miners did not tram their ore to shafts for hoisting, either not having facilities or thinking some other way better and cheaper. The mine was worked in a series of truncated conical vertical caves, the smaller end of the cones being at surface, the openings gradually growing larger in diameter as they increased in depth. Buckets hung on ropes were let down and were swung like pendulums as far from the horizontal as might be, in order to reach ore at the outer edge of the cave. When the bucket could be swung no further from the vertical and no ore could be thrown into it from the workings, no drifts were run and no ore was trammed to the foot of the opening, but another bottle-shaped shaft was started a few feet from the former.

In a space of but 200 to 300 ft. there exist half a dozen of these caverns, having a depth of about 300 ft. The result of this was that an enormous amount of waste was broken and hoisted, as it was necessary that each new cone should go down through all rock that lay in its course, in order to reach the enriched portions of the vein, beneath or to one side. Thus they were unable to make any close selection, but had to mine whatever lean ore came to hand. Furthermore, there were doubtless considerable quantities of good ore that they were unable to reach.

Old Method of Breaking Ground

There were other unfavorable conditions of early operations; among these the lack of candles or other suitable light, compelling the use of long pine splinters that gave off much smoke and fume. Then, too, many of the openings were made without explosives; wood was laid against the walls and set afire, and when these walls were sufficiently heated, water was dashed against them, breaking the rock. These lights and fires so filled the mines with smoke that old men say it was impossible to work underground more than four or five hours at a time. A full day's work, or energetic labor during the shortened period of the day, were alike impossible. But these miners did accomplish much. It is estimated in the meager historical records available that they produced during the period of activity more than 9,000,000 lb. of refined copper, and it is evident from the rock piles left on surface and the vast openings below that they moved out about 700,000 tons of ore and waste.

Conditions in the Old Stopes

It has never been my fortune to see elsewhere such a combination of caves, narrow passages, vast untimbered openings of tremendous hight yawning above me; knife-like flying rock-bridges and shelves upon which one must crawl between precipices, the blackness of whose unknown depths alone made is possible for a man to traverse them, or great blocks of copper or zinc sulphide ores, enormously heavy, ready to fall upon the slightest tremor, and occasionally doing so, unheralded.

Instead of sinking a shaft the present company dropped the loop of a long wire rope down the center of one of the truncated cones, fastened it at the bottom, leaving a space wide enough to serve as guides for a cage, and tightened it at surface. The hoisting was done in this skeleton shaft. Close beside it was an old stairway with occasional landings, some with rails, reaching from surface to the depth of 300 ft. I do not know of a more creepy undertaking than going down this ladder, no timbers surrounding it, no walls that could be seen, merely a single ribbon of small wire rope, nothing but inky blackness all about that candle light could not penetrate; the walls reverberated to every sound like a cavern; while the occasional landings were slimy with the talc, mica and other gangue material deposited during the many years that the mine was filled with water, and kept greasy by fresh deposits of the same materials brought up on miner's boots from day to day. There was but one other way into the mine, and that was about as bad, with its foot-wide passages and bridges over black openings of great depths, its many shaky ladders extending from one cavern to another, its tiny shelves on which one must creep around precipices, and its danger from falling rock.

Grade and Quantity of Ore

At the time of my examination there was to be classed as probable ore about 175,000 tons of copper-bearing rock, estimated at an average of 4 per cent. copper; a considerably greater tonnage is now said to have been developed, while much of what was then called probable is now proven ore.

The bibliography concerning this old mine, the only important mining enterprise in the Grand Duchy of Finland for many, many years, is exceedingly scanty. Otto Trustedt, of the Finnish government, states in a report on Orijarvi, written in 1908 and recently published by the *Kommissionen*, that "there does not exist any comprehensive history about the orebodies of Orijarvi, a want that has been keenly felt whenever this old mining field was to be described by foreign mining geologists. Even in the latest textbooks there is given about Orijarvi scarcely anything but the name."

Copper Was Used as Coin

In the early years the owners of this mine were permitted by the Swedish government to make a copper coinage, and a few of these coins are still extant. There is one complete collection in the national museum at Helsingfors, another one or two elsewhere, and several fragmentory collections are to be found in various parts of the world. John Daniel, of Laurium, Mich., has one of the best of these. This coinage was merely flat plates of copper of various sizes, up to about 12x18 in. and ⅓ of an inch thick, stamped on each corner with the arms of Sweden and Finland, and properly attested as to weight; enormously heavy, to be sure, for their monetary value. That was the time when a Finnish peasant, going to pay his tax of a few marks, must needs have a horse and cart with which to convey it to the treasury.

The Finnish-American Mining Company's operations are among the first attempts on the part of Americans to reopen the old mines of northern Europe, and particularly in view of the present activity in some American quarters in mining in Russia, are of more than passing interest.

"Brass Chills"

According to the *Journal of Industrial Safety*, in the brass foundry it has been the custom to question the existence of what is popularly called "brass founder's ague," or "brass chills." It seems likely that the sublimation of zinc in the melting and pouring process must be charged with the origin of the poisoning. Plainly ventilation, artificial or natural, helps greatly. A physical examination of 187 men representing 78 foundries showed 45 suffering from brass chills, or 24 per cent. Men recently employed are more susceptible to brass chills than the old employees, who acquire a sort of immunity or tolerance after a while; but the nervous system, the digestive tract, the lungs and the kidneys of such workers often show the effects of their occupational disease. The effects of the brass foundry on the length of life is shown by the fact that out of 1761 brass foundry men, only 17 were over 50 years of age.

Palladium is well adapted for parts of astronomical instruments and certain dental work and sells at $34 per oz., and pure rhodium, which is of considerable value in making high temperature determinations, is quoted at $155 per ounce.

Milling at the Florence-Goldfield

By Claude T. Rice

The capacity of the 40-stamp mill is 150 tons per day The gold is recovered by amalgamation, concentration and cyanidation; concentrates are shipped for chlorination. Milling costs are $2.69 per ton.

The Florence-Goldfield mill building was so crudely designed that, though it has been rearranged twice, it has been impossible to make it convenient. W. H. Barton, the superintendent, by making judicious changes in the original scheme of treatment has succeeded in obtaining an extraction of 93 per cent. of the gold in the ore, which averages about $12 per ton. The extraction is about the same as is being made on a somewhat similar ore at the Goldfield Consolidated mill where the ore averages more than $30 and the tailings discharged contain more than $2.50 in gold per ton. At the Florence mill the extraction is not made solely by cyanidation; by amalgamation 30 per cent. of the gold in the ore is recovered, by concentration 33 per cent. and by cyanidation 30 per cent.

The mill is treating from 150 to 160 tons of ore per day and the total cost of milling is $2.69. The principal items of expense are: Power and light, 71.2c.; crushing, 35c.; amalgamation, 12c.; concentrating, 15c., and cyaniding, 83c. The tailings discharged contain from 30c. to $1 per ton in gold and average about 70 cents.

Nature of the Ore

The Goldfield Consolidated ore is a mineralized dacite, andesite or latite containing much clayey matter in the form of alunite, whereas the ore from the Florence mines is mineralized dacite and andesite. In some places where the mines are particularly dry, there is a considerable quantity of crystallized ferrous sulphate which greatly increases the cost of cyaniding. The gold occurs in minute grains; much of it is rusty, while some occurs as a telluride called goldfieldite and in arsenic and antimony compounds. These last are unimportant.

The difficulty of treating the ore is ascribed to the presence of the mineral famatinite, a copper-antimony sulphide. Little trouble has been experienced from the presence of copper for it is possible to remove most of it by concentration by vanners after the pulp has been slimed. At present, as great a quantity of the slimed sulphides is thrown into the tailings as is consistent with the obtaining of good results in the cyanide department, in order that the quantity of concentrates may be kept small, because the concentrates are sent to a custom plant in the district where they are successfully treated by the chlorination process.

The superintendent states that he has found it possible to treat all the slimed sulphides and tellurides in the cyanide plant which pass the concentrators, provided he can maintain the cyanide solution below 0.02 per cent. copper. The only difficulty experienced is in the greater consumption of zinc when more than that amount of copper is in the solution.

Crushing and Amalgamation

The skips from the mine dump the ore directly into the mill bin, whence, after being weighed in a Fairbanks hopper scale, it goes to a No. 4 gyratory breaker and is broken to pass 1-in. ring. The crushed ore is elevated and distributed to the stamp-mill bin by belt conveyers and traveling trippers. There are 40 stamps weighing 1000 lb., arranged in two rows, that drop 6 in. 114 times per minute; and crush through 16-mesh vertical-slot screens against a hight of discharge of 2 inches.

The gold is amalgamated on eight tables, each 5 ft. wide by 16 ft. long, made of four plates, each 4 ft. long and separated by drops of ¼ in. The plates slope 1¼ in. per ft. At the bottom of each table there is a carpet apron 4 ft. long that serves as an amalgam trap. Below the tables there are amalgam traps of the usual type, and traps are also used above and below the hydraulic classifiers that were installed in the mill when first designed, as it was planned to concentrate on Card tables before regrinding in the tube mill.

The hydraulic classifiers are but little used now and the Card tables serve as efficient amalgam savers, for there are not enough coarse sulphide and telluride minerals in the ore to pay for the operation of two sets of concentrators. Moreover it was less expensive to treat some sulphide in the cyanide plant after removing as much as possible of the refractory minerals by vanners.

Regrinding and Concentration

Before flowing to the vanners the pulp is fed to the tube mills. There are three of these, each 5 ft. in diameter by 14 ft. long. Two are in operation all of the time. Pieces of quartz ore are sorted from the dump for use as grinders in the tube mill. All the pulp from the tube mill will pass an 80-mesh and 50 per cent. a 200-mesh screen. More complete sliming is not at present necessary. The pulp from the tube mills is raised by a centrifugal pump to the vanner feed-boxes. Centrifugal pumps are used throughout the mill for elevating pulp. The vanners are adjusted to make a very clean concentrate, the finer sulphides being thrown into the tailings together with practically all the slimes. The concentrates range between $150 and $200 per ton gold, from 1 to 4 per cent. copper, and 7 to 8 per cent. silica. These are sent to the chlorination plant which pays for 95 per cent. of the gold at mint price.

Cyanide Treatment

The tailings from the vanners are raised by two Aldrich plunger pumps to the three collectors, 36 ft. diameter by 18 ft. deep. The water overflows into two clarifiers which are also 36 ft. diameter and 16 ft. deep. From the clarifiers the overflowing water is returned to the stamps, while the pulp in the settlers is drawn from time to time as needed, to the Pachuca agitators.

The agitators are 17 ft. deep by 17 ft. diameter. They were made from old Woods screw-agitators; the screw was removed and a jet put in to supply air at the bottom of the central tube in which the screw was rotated. An air pressure of 18 lb. per sq.in. is used in agitating. It has been found that the area of the air-jet nozzle must be restricted and the pressure reduced at the orifice instead of by a valve in the pipe line in order to get the full efficiency of the air agitation. This is somewhat upon the same principle of reducing the discharge of a nozzle from a garden hose in order to get a greater range of the stream.

The density of the pulp during agitations is maintained at 1.4, or as near that as possible. The cyanide solution is made up in the agitators. Lime is added at the gyratory crusher in sufficient quantity so that the pulp is neutral when it reaches the agitators. There more lime is added to give an excess alkalinity equivalent to ½ lb. per ton. The strength of the solution is kept a little above ½ lb. per ton. This solution generally carries about 0.02 per cent. copper. About ½ lb. of lead acetate is added at the agitators for each ton of dry ore, just before the cyanide is added to the charge. The agitation lasts from 6 to 8 hours. There are four agitators, two of which are kept in constant operation.

Filtration and Precipitation

From the agitators the pulp goes to the Butters storage vats. The cycle at the Butters filter, which contains 90 leaves, 5x10 ft., is from 3 to 3½ hours. In filtering a vacuum of from 20 to 23 in.

is used. With pulp of 1.4 density it takes 1½ hours to form the cake, while with pulp of greater density it takes two hours. The thickness of the cake is from 1 to 2½ inches. In starting to form the cake a low pressure, about 5 in., is used for 20 min., so as to form an even cake while, in order to keep the pulp thoroughout the tank at as even density as possible, the pulp is kept in circulation by means of a centrifugal pump which returns it to a header pipe running along the top of the filter. All cakes are washed with barren solution for 1½ hours before being discharged, so that the length of the cycle varies between 3 and 3½ hours.

The filter leaves are made of 10-oz. canvas with an 8-in. header board, no cocoa matting is used, but wooden strips are placed between the stitchings of the canvas. The company makes its own filter leaves at a cost of $12.

The precipitation is effected by means of zinc-shavings. In cleaning the boxes the short zinc is taken out and that portion which does not pass a 40-mesh screen, together with the precipitate, is treated with sulphuric acid, for as the shorts contain much copper, they have practically lost all their precipitation qualities and it would not pay to return them to the boxes. A feature of the precipitation room is that barrels are used as zinc-boxes, permitting a more efficient use of the zinc than the usual type of box. The tail solutions from the boxes rarely exceed 5c. per ton in gold.

The extraction on the pulp going into the cyanide department is only 80 per cent. The heads assay from $2 to $3 per ton, often being lower than the tailings that are discharged to the pond at the Goldfield Consolidated mill. The consumption of chemicals in the treatment of the ore is mercury, 0.15 lb.; lime, 6 to 8 lb.; lead acetate, 0.45 lb.; cyanide, 1.3 lb.; and zinc, 0.25 lb. per ton.

Mohawk Mining Company

The report of the Mohawk Mining Company, for the year ended Dec. 31, 1910, shows a net profit of $188,083 on a production of 11,412,066 lb. of copper. Dividends of $200,000 were paid, $54,368 expended in construction, and a net surplus carried forward of $496,375.

There were 906,423 tons of rock hoisted, 802,537 tons of rock stamped, 15,013,500 lb. of mineral recovered, and 11,412,066 lb. of copper produced, a 76.01 per cent. recovery on the mineral, and a 0.711 per cent. recovery on the rock. The cost per ton of rock hoisted was $1.267; per ton of rock stamped, $1.433. The cost of refined copper at the mine was 10.076c.; smelting, freight and marketing product, 0.889c.; construction, 0.484c.; total, 11.441c.

The financial statement shows that the total paid-in capital and assessments amount to $1,799,990, and that dividends paid amount to $2,150,000 and that there is a balance of liquid assets amounting to $496,375. Since the incorporation 76,464,219 lb. of copper have been produced and sold, netting $11,143,026, or 14.6c. per lb. Sales of "mohawkite" amounted to $116,408. The Mohawk is one of the owners of the Michigan Smelting Company, holding 3200 shares out of 20,000 issued.

[Michigan Smelting Company stock is said to be held as follows: Baltic, 3200 shares; Champion, 4400; Trimountain, 4400; Atlantic, 1600; Mohawk, 3200; and Wolverine, 3200; that is, 12,000 by the Copper Range group and 8000 by the Stanton group. Mohawkite is an arsenide of copper, nickel and cobalt, corresponding to the formula $(Cu, Ni, Co)_3As$. It carries 63 to 69 per cent. Cu; Ni, 3 to 7; and Co, 0.5 to 2 per cent.—EDITOR].

North Star Annual Report

The report of the North Star Mines Company for the year ended Dec. 31, 1910, states that the production was $1,232,934, at a cost for operation of $505,792, and for development $50,068, leaving an available profit of $677,074, of which $575,000 was distributed as dividends amounting to 23 per cent. of the capital stock. Since April 10, 1899, the amount of ore treated totals 646,591 tons that yielded $13.19 per ton at a cost of $7.88, of which $2.08 was for development. From May, 1884, to Dec. 31, 1910, there was mined 837,956 tons of ore that yielded $14.29 per ton. During the last year 90,110 tons of ore was mined and milled that yielded $13.68 per ton at a total cost of $6.17 per ton, of which $0.56 was for development.

NORTH STAR EARNINGS AND EXPENSES

North Star mine:		
Incline shaft, 21,540 tons at $4.739		$102,082
Central shaft, 68,570 tons at $3.081		211,273
Mills—North Star, 44,375 tons at $0.570		25,301
Central, 45,735 tons at $0.530		24,245
Cyanide plants, tailings, 87,511 tons at $0.532		46,575
Concentration and cyanidation of concentrates, 2049 tons at $6.340		12,990
General expense (per ton, $0.944)		85,034
		$507,500
Less sundry receipts		1,708
Total expense (per ton $5.163)		$505,792
Development expense (per ton $0.556)		
North Star mine:		
Upper workings	$9,434	
Lower workings	40,634	
		50,068
Cincinnati Hill development		16,416
Improvements		7,148
Property purchases		36,486
		$615,910
Dividends, 23-26		575,000
Balance on year's production		42,024
Total yield from ore		$1,232,934
Interest and dividends		44,631
Total gross earnings		$1,277,565

DEVELOPMENTS

The development work done during the last year amounted to 3346 ft. in drifts and raises, as compared with 7020 ft. done the previous year. The reduction in development work was due to a considerable decrease of exploration in the upper levels, above the 2700-ft. level, because the limit of profitable exploitation seemed to have been reached, and in the lower levels, because the extensive developments of recent years justified some curtailment.

During the last year 21,540 tons of ore, yielding $10.75 per ton, was mined above the 2700-ft. level, from which a profit of $3.43 per ton was made. The recent prospecting work has failed to reveal any new resources of value and the early months of 1911 will see the practical exhaustion of ore in this part of the mine, a result which has been foreseen for several years.

NORTH STAR FINANCIAL STATEMENT, MAY, 1884, TO END OF 1910

RECEIPTS.

Production, 837,956 tons at $14.293		$11,977,980
Operating expenses	$6,400,525	
Developments	1,412,574	
		7,813,099
Profit		4,164,881
Assessment (1885)		20,000
Working capital stock		1,007,531
Interest and dividends received		219,814
Investment profits		19,742
Sundry		1,822
		$5,433,789

DISBURSEMENTS

Mining properties purchased for cash in addition to North Star mine for which capital stock was originally issued		$510,770
Improvements:		
North Star mill, hoist, etc.	$158,564	
Buildings and machine shops	19,027	
Stockbridge shaft	58,212	
Power house and shaft	109,437	
Central shaft equipment	119,737	
Central mill	77,178	
Cyanide plants:		
North Star	40,914	
Central	58,615	
Residence	24,821	
Electric railway	31,041	
Cincinnati hill	4,794	
General, assay office, etc.	7,424	
Pipe lines and water property	105,752	
		815,516
Dividends		3,061,989
Balance, investments, supplies and cash		1,045,514
		$5,433,789

Development between the 3000- and 5000-ft. levels not only confirmed previous expectations of revealing profitable ground, but opened a further supply of ore equal at least in amount, and probably in grade, to that extracted during the year. It is not possible to make any precise statement of total ore reserves now available, but developments already made indicate that the present scale of operations can be maintained for several years to come.

A new development was undertaken during the year on the Cincinnati Hill claim that was recently purchased by the company. A shaft was sunk to a depth of 340 ft. without disclosing ore of value, but the character of the ground justifies further exploration.

According to the Colorado Bureau of Mines the copper production of that State in 1910 was 8,304,312 pounds.

Brejcha Method of Diamond Drilling

By Victor Sangoy

Cement grouting used instead of casing tubes; diamonds are set in molten solder in steel plugs. The diamond expense is about 60 fr. per meter.

The methods adopted in testing for the Rive-de-Gier coal beds in the Saint Etienne basin involved principles not commonly employed in America. The geological conditions surrounding the work need not be repeated here, but the actual method of drilling is interesting.

The Brejcha system[1] differs from others in three particulars: In the setting of the diamonds; in the use of cement grouting instead of casing pipes where it is necessary to support the walls of the hole; and in directing the current of wash water down around the outside of the drill rods and up through them, instead of in the opposite, and more usual, direction.

By avoiding the use of casing pipes, a saving is effected through the possibility of starting a hole but little, if any, larger than it is required to be at depth. The object of the inverted flow of wash water is to minimize the wear that ordinarily occurs, particularly in soft or schistose rocks, or coal, between fragments of the core which break apart in the core barrel; the upward flow of water through the barrel is thought to diminish the pressure and friction of one fragment on the next one below it, and thus yield a larger percentage of core.

Equipment Required

The equipment employed consisted of a derrick 16.2 m. high; a shed 16.8x6.4 m., covering a portable boiler of 15 to 20 h. p.; a hoisting drum; pump for injecting water or cement grouting; cement mixer, and the boring apparatus The mixer, shown in Fig. 1, consisted of a strong iron drum with a covered opening at *B* for the introduction of cement, and a shaft, turned by hand, carrying a pair of perforated paddles. By means of the pipe connections shown in the Fig. 1, the water from the pump could pass into the drill rods either through the mixing drum or through the bypass, the latter being the usual route during drilling.

The boring machine comprised the following parts: Swivel head; driving sleeve; rotating device; drill rods; core barrel, and diamond bit.

The swivel head, shown in Fig. 2, was designed to support most of the weight of the rods on steel balls, *N*. The dish-shaped receptacle catches the overflowing water and sand, discharging them through a pipe at one side. The stuffing box, shown at the top of the figure, is screwed into place only when it was desired to reverse the flow of wash water through the rods.

[1]Translated from an article in the *Bulletin* de la Société de l'Industrie Minérale, Sept., 1910.

The driving sleeve, shown in Figs. 2 and 3, is 90 mm. outside diameter, 7 mm. thick and 4.7 m. long, having two projecting feathers or splines diametrically opposite and extending throughout its length. Its upper end carried the shoulder, *P*, turning on the steel balls, *N;* its lower end passes through the rotating device, being driven by the latter through the medium of the two splines.

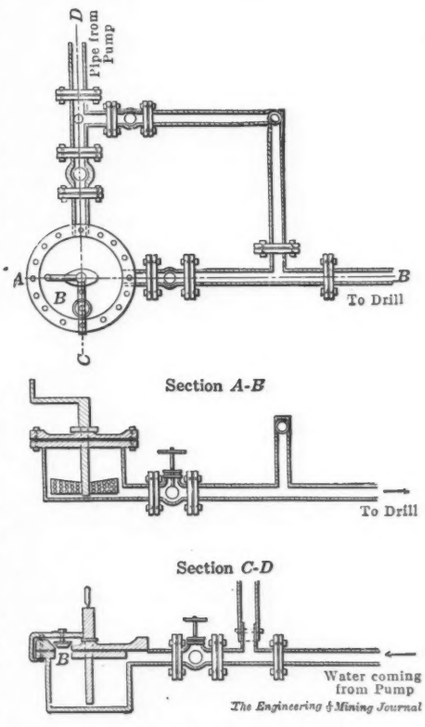


Fig. 1. The Cement Mixer

Rotating Device

The rotating device is shown in Fig. 3, the outer shell being cast iron. The bottom part is imbedded in concrete, forming a closure for the top of the drill hole as well as a standard for the machine. The method of transmitting rotation by means of splines free to slide up and down through a revolving collar is the same as is commonly adopted by the best known diamond drills in America.

The drill rods, Fig. 4, were of two sizes, heavy ones being used to start the hole, and lighter ones to finish it. The first had an exterior diameter of 70 mm., a thickness of 6 mm., and lengths of 5 m., weighing 17 kg. per meter. The smaller rods were 51 mm. outside diameter, 5 mm. thick, 5 m. long, and weighed 10 kg. per meter. At each end was a slightly conical screw of square threads, for connecting two rods together. Rods of the lighter size were sometimes coupled by an outside sleeve. Near the top of each rod were cut two opposite flat spaces, 50 mm. high, for the purpose of applying wrenches for coupling and uncoupling. The uppermost section of rod was inclosed by the driving sleeve, and received its rotation from the latter through two lugs projecting into corresponding notches on the upper edge of the collar which formed the top of the sleeve.

The core barrel and core lifter employed by the Brejcha system are practically identical with corresponding parts used in the ordinary American method, but the diamond bit is wholly different in design and in the method of inserting the stones.

The Diamond Bit

The cylindrical bit is made of soft steel, as illustrated in Fig. 5. The outside diameter is 73 mm., the inside diameter 53 mm., leaving 10 mm. of metal in the walls. Four rounded grooves are cut vertically on both outside and inside surfaces, to allow free circulation of water. Bored upward in the lower edge of the bit are 14 holes, of 6.7 mm. diameter, tapering at their inner ends and so inclined as to break through the outer or the inner wall of the cylinder, in a small aperture. Four other similar holes are bored inward from the outer wall and two more outward from the inside surface, making provision for 20 diamonds so placed with respect to one another as to cover the grinding surface completely as they rotate.

The diamonds are not bedded directly in the steel of the bit, as in American practice, but are fixed in little conical pieces of steel, which are then inserted into the holes in the bit; this method is thought to permit a more rapid exchange of stones and to reduce the wear on both stones and bit. The little steel plugs carrying the worn diamonds are simply forced out of their sockets by driving a steel pin through the small apertures provided for that purpose, and other plugs previously fitted with fresh diamonds are inserted in their places.

The stones are fitted into the little steel plugs in the following manner: Starting with a short piece of soft steel bar, 1 cm. square, a shallow hole, slightly larger in diameter than the stone to be inserted, is drilled in one side, near one end. Turning then to the special tool illustrated in Fig. 6, the diamond *A* is placed in the spring socket *P*, and the square steel bar, hole uppermost, is laid on the anvil *M*; by means of the thumbscrews *S S*, the guiding arms *G G*, are so adjusted as to hold the hole in the square bar exactly under the diamond, when the lever *L* is depressed. The hole in the bar is then filled with solder, which is heated until it melts; the bar is then replaced in position on the anvil

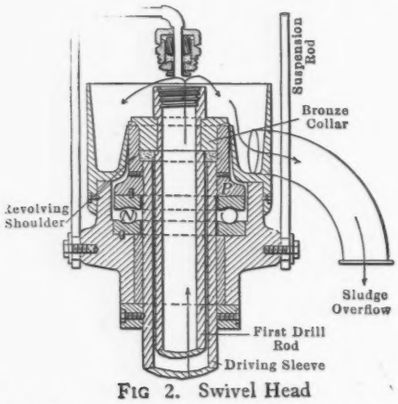


FIG 2. Swivel Head

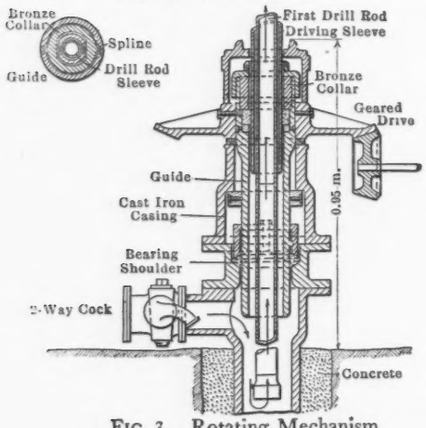


FIG. 3. Rotating Mechanism

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and the diamond forced into the melted solder by a quick stroke of the lever. The spring *R* absorbs superfluous force, so that the stone may not be crushed. The bar is then immediately cooled in water. When carbonados are used, extra precautions must be observed to chill the stone at the instant that it is inserted into the melted solder; this is accomplished by connecting the tube *T* by a rubber pipe, to a source of cold water, a jet of which is produced just as the stone enters the cavity. When the diamond has been successfully seated in the square bar, the end of the latter is turned in a lathe into the form of a cone, 20 mm. long (Fig. 7), and cut off from the rest of the bar.

Three forms of diamonds were tried, carbonados, borts and balas stones. Carbonados, being angular, were found unsuitable for this particular work, although they might serve for boring in fine grained, uniform rocks; they cost about 100 fr. per carat. Borts are rounded, but as they consist of an aggregate of minute crystals, cleavage soon developed and the stones broke while boring in rocks of irregular texture; as

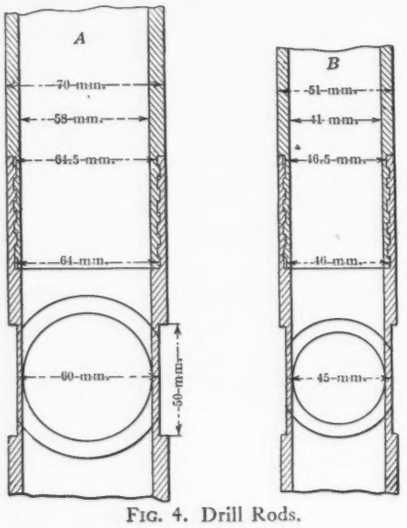

FIG. 4. Drill Rods.

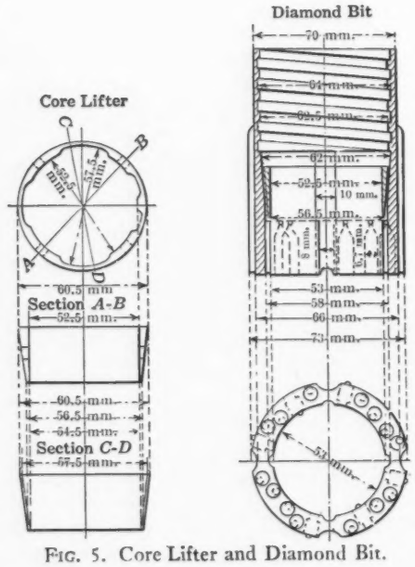

FIG. 5. Core Lifter and Diamond Bit.

they cost only 18 to 20 fr. per carat, they were quite commonly used. Balas stones, being round and homogeneous, gave the best satisfaction; they cost about 300 fr. per carat. The consumption of diamonds was exceedingly variable: For the first 600 m. it averaged only 28 fr. per meter, then rose for a short distance, while traversing a fissured zone, to 500 fr. per meter; the average for the whole 1152 m. was about 60 fr. per meter.

REGISTERING DEVICE

To avoid the possibility of passing through a coal seam without noticing the fact by failure to observe the color of the sludge, an automatic device was constructed for recording the progress of the drill rods. As shown in Fig. 8, it consisted of a drum *A*, on which was wound a light cord which passed over a pulley and was fastened to the swivel head of the drill. The shaft of this drum

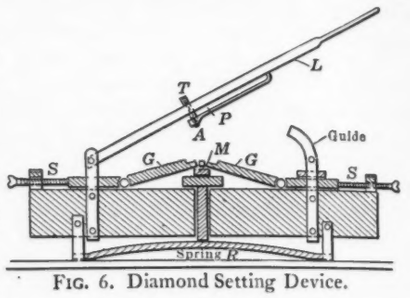

FIG. 6. Diamond Setting Device.

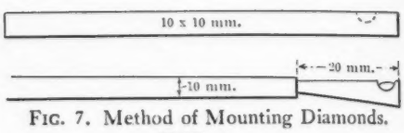

FIG. 7. Method of Mounting Diamonds.

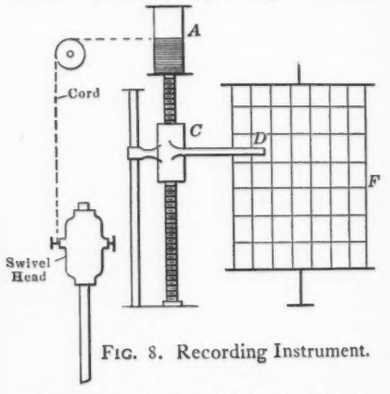

FIG. 8. Recording Instrument.

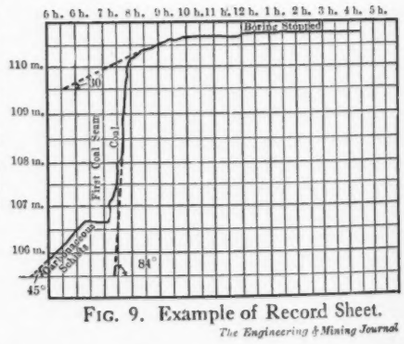

FIG. 9. Example of Record Sheet.

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was threaded, and passed through the traveling nut *C*, from which projected an arm *D*, bearing a pencil in contact with the graduated paper on the drum, *F*. As the drill rods descended, it is obvious that the pencil would trace a rising line on the ruled paper. The scales adopted for the ruling of this paper were 5 cm. per meter for the depth, and 3 cm. per hour for the time; the registering cylinder rotate, once in 12 hours, and could record an advance of 6 m. in that period.

The average speed in sandstones and similar rocks was 50 cm. per hour, corresponding to a rising slope of about 45 deg. on the recording diagram; while passing through a coal seam, the speed would rise to 420 cm. per hour, recording a line which would be almost vertical. During stoppages for hoisting and lowering drill rods, the depth indicator was held stationary, making a horizontal mark on the recording sheet until operations were resumed. A sample record is shown in Fig. 9, and these being kept on file, an indisputable record of the coal seams was procured.

Operating Details

The actual boring operations were conducted in much the same way as is usual in America and elsewhere with other types of diamond drill. A pit 1 m. square was dug to bed rock, a piece of cast-iron pipe of 250 mm. diameter was put in and surrounded with concrete, the hole was started with a diameter of 156 mm. to a depth of 20 m. and was cased with pipe to act as a guide. As the hole then had to pass through an abandoned coal seam with caved roof and hydraulic filling, it was further cased to a depth of 111m., with 108- and 95-mm. pipes. Below 111 mm. no casing was used. The hole had a diameter of 78 mm. to a depth of 285 m., 76 mm. to 320 m., 74 mm. to the 500-m. point, and 73.5 mm. for the remainder of the 1152 meters.

The rods rotated at 60 r.p.m. The longest solid core obtained measured 16.5 m., but the average over the whole depth was only 2.3 m. The volume of water needed was 5 cu.m. per hour, corresponding to a velocity upward through the 41-mm. drill rods of 1 m. per sec. Friction and the falling tendency of the solid grains reduced the velocity of the latter to such an extent that it required about 25 min. for sand to reach the surface from 700-m. depth. The normal pump pressure was 4 kg. per sq.cm., increasing sometimes to 15 or 20 kg., when obstructions were met.

Drill rods were hoisted and lowered, and the feed of the rods through the driving sleeve was arranged in precisely the same way as with ordinary drills. Before breaking off the core, the water current was stopped for a moment so as to allow the suspended sand to settle down around the core, assisting the action of the core lifter, and protecting the core somewhat from breakage during its journey to the top. On lowering the rods, they were always stopped at least 1 m. from the bottom, wash water was circulated for at least half an hour, and the rods were rotated while gradually being lowered into position to continue cutting. Hoisting, washing and lowering to the bottom of the hole, 1150 m.; occupied nine hours.

Cementing Process

A distinctive feature of the Brejcha method is the use of cement grouting to take the place of casing pipes through fissured or watery zones. The treatment of strongly fissured, porous rock differs from that required for passing through more compact rock in which the fissures, with or without water, are more isolated.

In the first case, injection of cement can go on without stopping the boring, by simply switching the flow of wash water into and through the cement mixer, as indicated in Fig. 1. Two sacks of screened cement are poured into the mixer, with some water, and the crank is turned until the grouting is thoroughly mixed. The valve leading to the drill is then slowly opened, allowing the grouting to mingle with the wash water; as the fluid cement passes down along the wall of the hole, under increasing pressure, it naturally penetrates into any open fissures and solidifies there. If the fissures are so large and numerous as to require a continuous flow of grouting, two mixers may be installed in parallel pipe lines, so that the mixtures can be made alternately and fed into the hole without interruption.

Cementing in Compact Rocks

In dealing with more compact rocks, but with larger cavities or fissures, several cases may arise. If it is only a cavity, without a flow of water, some quick setting cement is made up into a conical, sausage shaped plug, and lowered into the hole. If the plug does not stop and expand by itself at the right spot, it should be made slightly larger than the hole; on pushing it down with the drill rods it can then be stopped at any desired point. A small amount of grouting is then poured on top of the plug, and time is allowed for it to set. Then enough grouting is poured in through the drill rods to solidify the cavity, the rods being slowly withdrawn as the cavity fills. After 36 hours it will usually be safe to resume drilling in the ordinary way. A speed of 25 m. per hour can readily be maintained through the cement plug. While drilling through cement, it is a good plan to force the wash water down inside the rods instead of up, with the object of disintegrating the core as much as possible, and thus avoid the necessity of hoisting the rods with the usual frequency, to no useful purpose. It is an obvious advantage to use the quickest setting cement available.

In case an inrush of material is met at or below a cavity, boring is continued past the fissure, and cement is then forced by the pump down through the rods and up between them and the sides of the hole into the running material; on drawing the rods up slowly, while continuing to feed cement, the hole can be solidly filled up to a point above the cavity. If a fissure should be met which drains water out of the hole, cement may be forced down the rods under heavy pump pressure, so as to cause it to penetrate as far as possible into the fissure before setting. In these two last mentioned cases, three or four days should be allowed for the cement to set before resuming boring.

Electric Power to Melt Metals

Whether electric power is or is not economical for melting metals, it is not alone a question of kilowatt-hour cost, but is also a function of the relative efficiencies of the fuel-using and the electric furnace. This question was recently discussed before the American Brass Founders' Association, by Prof. J. W. Richards, who gave the accompanying table of constants. The column "just melted" shows the number of Calories required to bring a kilogram of metal to bare fusion, while the column "superheated 10 per cent." shows the number of Calories required to bring a kilogram of the metal to a temperature 10 per cent. higher in Centigrade degrees than its actual melting point.

CONSTANTS OF FUSION.

	Melting Point.		Heat in Melted Metal.	
	Degrees C.	Latent H't of Fusion.	Just Melted.	10 per cent. Superheat
Ag	962	24	89	96
Al	645	100	258	278
Au	1054	16	51	55
Bi	267	12	21	22
Ca	780	53	186	202
Cd	322	13	32	34
Co	1500	68	329	359
Cu	1085	43	162	176
Fe	1600	69	336	368
Ir	1950	28	113	123
K	58	16	27	28
Li	180	73	242	257
Mg	750	58	246	271
Na	97	32	78	81
Ni	1450	68	290	319
Pb	326	4	16	17
Pt	1775	24	89	102
Sb	632	40	74	78
Si	1430	128	555	622
Sn	232	14	28	29
Te	455	19	46	49
Th	290	6	16	17
Zn	419	23	68	73

Doctor Richards gives the efficiency of good oil furnaces at about 17 per cent., coke furnaces at about 18 per cent. and the electric furnace at 50 per cent. On these figures, which would, however, have to be determined for each individual installation, coke at $4 is equal to oil at $6, and electric current at $12.25 per horsepower-year.

The waters of some Western lakes, as Owens and Mono lakes, California, contain potash and indicate that the beds of evaporated lakes in the desert regions of California and other States may include large amounts of potash.

The Iron Ranges of Minnesota

By Edgar K. Soper *

Present producing ranges are the Vermilion and Mesabi. The Cuyuna may be a future rival. Open-pit methods now prevalent, but half the ore must eventually be mined by underground methods.

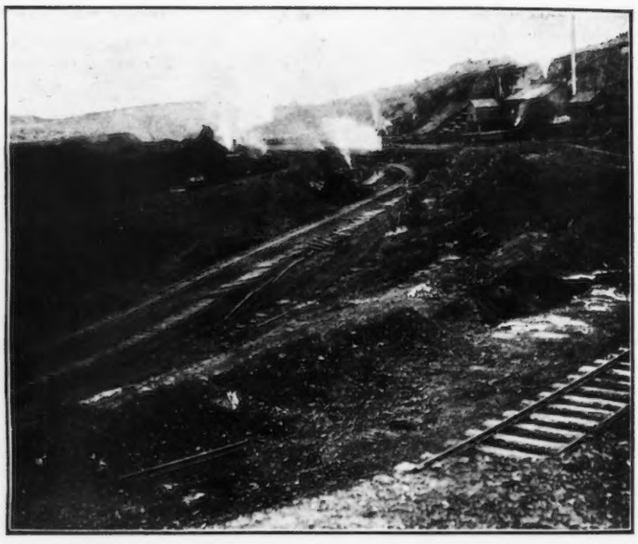
*University of Minnesota, Minneapolis, Minn.

Iron and steel together constitute the largest manufactured product in the world and enter into every branch of human industry. Iron is outranked in importance by only one mineral product; i. e., coal, and the United States leads the world in the production of both of these substances.

Hematite Ore Predominant

The minerals which serve as the principal ores of iron are: (1), hematite (Fe_2O_3), which contains, when pure, 70 per cent. iron and 30 per cent. oxygen; (2), magnetite (Fe_3O_4), containing, when pure 72.4 per cent. iron and 27.6 per cent oxygen; and (3), limonite ($2\,Fe_2O_3.3\,H_2O$), containing, when pure, about 60 per cent. iron. Of these, by far the most important is hematite, because of its occurrence in vast deposits, and also because of the ease and cheapness with which it can be mined and smelted.

Surface Plant of Underground Iron Mine



Openpit Work, Mesabi Range

The United States produces nearly as much iron ore as all the rest of the world, exclusive of Germany, and about twice as much as Germany alone. By far the largest amount of this ore comes from the hematites of the Lake Superior region. There are six large producing districts or "ranges" in the Lake Superior region which furnish most of this ore. These are; (1), the Mesabi range in northeastern Minnesota; (2), the Vermilion, in northeastern Minnesota; (3), the Marquette, in Michigan; (4) the Crystal Falls, in Michigan; (5), the Menominee, in Wisconsin; (6), the Penokee Gogebic, on the Michigan-Wisconsin boundary. Of these, the largest and most important, the Mesabi of Minnesota, is also the youngest. In addition to these, several newer and less important districts in the Lake Superior region produce ore, and one of these at least is probably destined to attain considerable importance.

History of Iron Mining in Minnesota

The two producing ranges in northern Minnesota are entirely distinct. Mining began on the Vermilion range, at the Soudan mine, in 1884, at which time the Duluth & Iron Range Railroad was finished as far as the town of Tower, situated on Vermilion lake. Some years later, extensive bodies of iron ore were discovered farther north, on the south shore of Ely lake, and the railroad was pushed through to that point. For eight years the Vermilion country furnished all of Minnesota's iron ore, but in 1892 the Mountain iron mine, southwest of Ely, in St. Louis county, on the Mesabi range made the first shipment of ore from that district.

Since that time the production of the Mesabi has increased steadily from year to year until today it is the most important iron-producing district in the world. St. Louis county alone produces three-fifths of the Minnesota ore, and the shipments in 1909 amounted to 29,282,526 tons. The first shipment from the Mountain iron mine in 1892 consisted of 4248 tons. Since that time the Mountain iron mine has produced 17,200,000 tons. There are 92 producing properties on the Mesabi, and in 1909 these produced a total of 28,174,000 long tons. Since the range was first opened, and up to Jan. 1, 1910, the shipments from the Mesabi range amounted to the stupendous quantity of 195,700,000 tons, which added to 29,125,000 tons from the Vermilion range, gives a grand total of 224,825,000 tons of iron ore produced in Minnesota.

The production of the Vermilion range has shown a marked falling off of late years, but the Mesabi has probably not yet reached its maximum. In addition to these two iron-ore districts, there is a third range in Minnesota which is being rapidly developed and already several preliminary shipments are reported. This is the new Cuyuna range situated in Crow Wing county, about 100 miles west of Duluth. This district was located from results of magnetic work done by Cuyler Adams about 1895, but little work was done outside of exploration until 1904. During the last few years the results of exploratory drilling have shown the existence of large bodies of commercial ore, and at present all indications point toward a rapid development of an iron district which may rival some of the old ranges.

The Vermilion Range

There are two separate districts in the Vermilion range, the first and oldest at Soudan, near Tower, and the second at Ely. During the last year the Ely district has been extended six or eight miles northeast to Sec. 30 where a new orebody has recently been found.

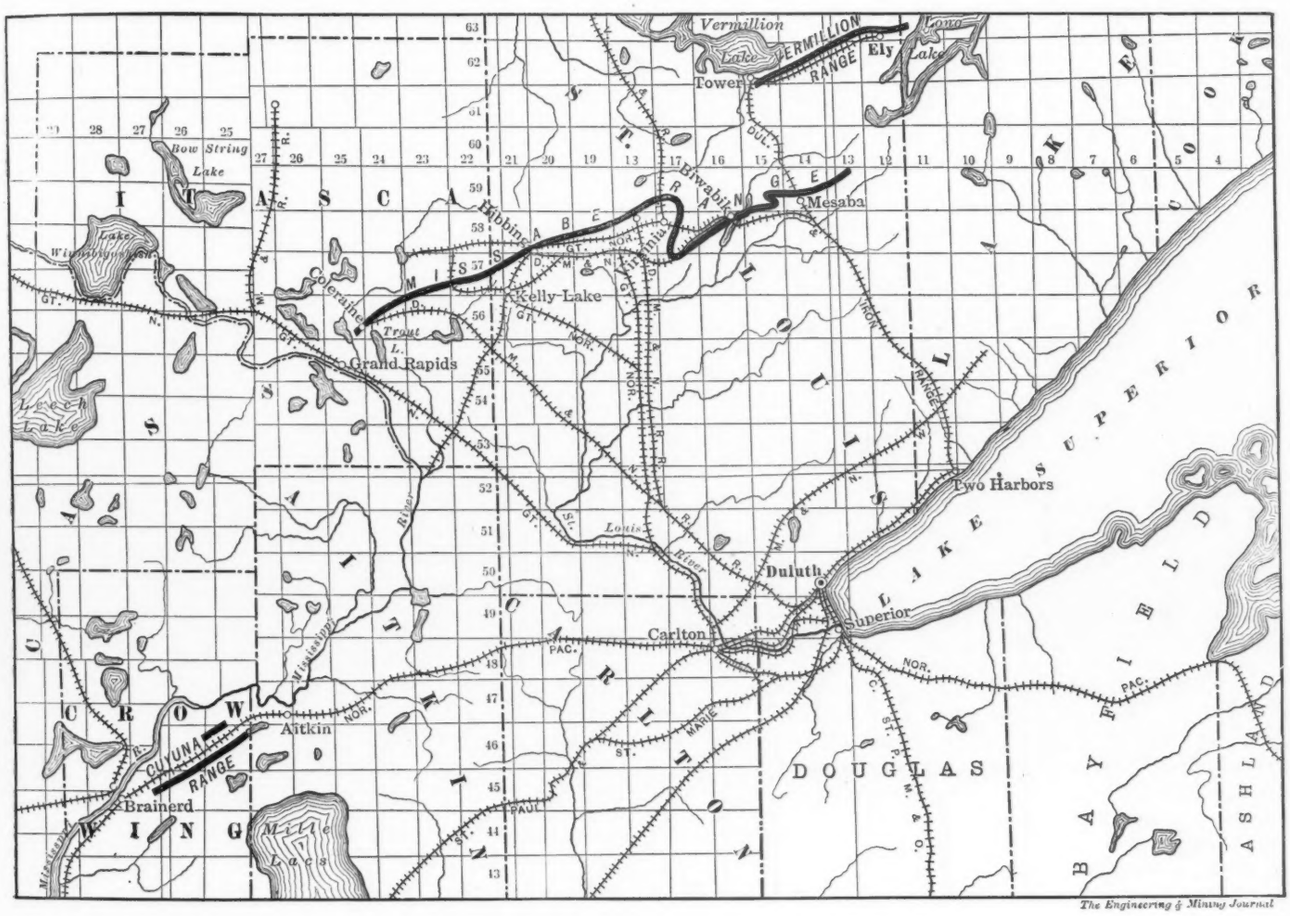
The rocks of the Vermilion district consist of ancient greenstones, granites, slates, jaspers, conglomerates and volcanic intrusives. Most of the ore occurs in what is known as the Soudan formation, probably of Archean age. The geologic structure of the region is one of extraordinary complex folding. This folding, together with the accompanying intrusions of volcanic material, has resulted in profound metamorphism. The ore deposits are irregularly distributed, and are usually of uncertain size and shape.

They are all folded so as to constitute pitching troughs occupying overturned synclines and the ores rest on impervious rocks, usually greenstone or soapstone, its altered equivalent. All of the mines at Ely are situated in the "Ely trough," an overturned syncline extending approximately east and west. The orebody lies in this trough and reaches its maximum dimensions near the western end. Both the north and south walls of the orebody are spoken of as footwalls, for each dips toward the axis of the trough. Toward the eastern end of the trough the soapstone, which usually occurs between the ore and the greenstone, is lacking in places, so that the ore lies in direct contact with the greenstone.

Ore and Soapstone Contact

The contact between the ore and soapstone is always well defined and sharp, but the soapstone and parent rock (greenstone) grade into each other gradually. There are several different phases of this altered greenstone, and "slickensides" are often present. Even the ore is sometimes slickensided. Water is always encountered at or near the contact of the ore and soapstone and is one of the best indications of approaching the limits of the orebody. However, there are occasional seams of soapstone in the ore, so that it is deemed advisable in exploration always to drive through to greenstone so as to be sure the limit of ore has been reached. Little jasper, with which the ore occurs, is exposed on the surface, but good outcrops occur on the property of the Pioneer mine. The ores, which are chiefly hard blue and red hematites, were probably produced from an original cherty carbonate of iron.

The iron carbonate was partially oxidized *in situ* to an oxide of iron and a further concentration of the ore was accomplished by descending waters which carried the iron downward and deposited it in troughs. The silica which was present originally in large amount, was removed in solution, thus effecting a further concentration of the iron. In addition to the hard massive ores, there is considerable brecciated, or crushed, ore which has been recemented. This brecciated material is less compact than the massive hematite and occurs chiefly at Ely associated with the unbroken ore.



Map Showing the Minnesota Iron Ranges

Producing Mines—Vermilion Range

There are six producing mines on the Vermilion range. These are, with their production for 1908: Tower district, Soudan mine, 53,070 tons; Ely district, Chandler mine, not worked; Pioneer, 525,045 tons; Zenith, 108,536 tons; Sibley, 144,559 tons; Savoy, 55,377 tons; Section Thirty mine, not reported. These are all controlled by the United States Steel Corporation, except the Section Thirty mine, which has just become a producing property during the last year,

and is still largely in a state of development. The Soudan mine, which was the first iron mine in Minnesota, is still producing a large amount of high-grade ore, although the production has dropped off notably in late years.

In the earlier period of mining some of the ore from this property was taken from near the surface by openpits, but now the ore is all mined by underground methods. The Soudan shaft, which is the deepest in the State, is down over 1300 ft. On account of the great depth to which the orebodies extend, the narrowness of the deposits, and the hardness of the ore, openpit mining is not practicable.

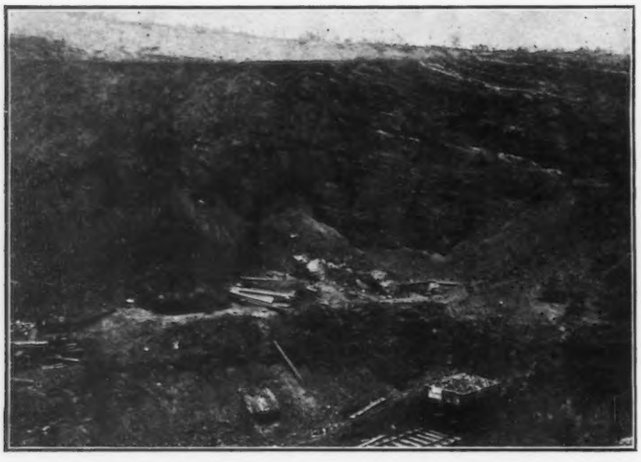
Chandler Mine Once Abandoned

The largest mine at Ely is the Pioneer, and this property is the largest producer on the Vermilion range at the present time. The Chandler was thought to be worked out and it remained idle for some years, but in 1910 a lease was taken on the property and considerable ore (estimated at 300,000 tons) is said to have been found in the upper levels. The new Section Thirty mine, recently opened, may be compared to the Pioneer mine at Ely as far as the geologic features of the orebody are concerned. The ore is hard blue hematite and occurs between a greenstone foot and a jasper capping. The banded jaspers which outcrop over a large area here are probably the most typical in the district. These outcrops naturally led to extensive exploration in this locality and for the last 20 years drilling has been done at frequent intervals. The orebody was located only recently, however, previous drilling having failed to expose its presence.

Caving System Almost Universal

All of the mines on the Vermilion range except the Soudan, have adopted the caving system of mining. By this method the hard ore is cut up by drifts, crosscuts and raises, into cubes of 25- or 30-ft. sides. Then additional raises are driven to the centers of these blocks. When the mass is thus honeycombed, its own weight causes it to crush slowly, and by the time it is desired to take out the ore, it is usually well crushed and broken and will flow easily into the chutes.

The ore between each two main levels (usually about 100 ft. apart vertically) is divided into three "subs" or layers, and the top "sub" is caved first. Thus, as the crushed ore is drawn off through the chutes, the overlying material gradually settles down until it rests on the ore beneath. An illustration shows the sunken surface at the old Chandler mine over one of these old caves. During the winter the ore hoisted is piled at the surface and later is loaded by steam shovels into steel railroad cars of 50 tons capacity, and hauled to the ore docks at Two Harbors, Minn., where it is loaded into boats for transportation to the blast furnaces.



Ore Wall Showing Syncline, Biwabik Mine

Ore and Glacial-drift Contact, Taconite Horse

Geology of the Mesabi Range

The Mesabi iron range comprises a narrow belt of territory varying from two to 10 miles in width, and extending from a point a few miles east of the village of Mesaba, southwestward to Grand Rapids, a distance of approximately 100 miles. The total area included is about 400 sq.m. The name is derived from the Giants or Mesaba range of mountains, along whose gentle southern slopes the iron formation is found.

GEOLOGIC COLUMN—MESABI RANGE.

Pleistocene	Glacial drift
(Unconformity)	
Cretaceous (scattered occurrences.)	
(Unconformity)	
Keweenawan	Diabase, gabbro and granite
(Unconformity)	
Upper Huronian	1. Virginia slate
	2. Biwabik (iron-bearing formation)
	3. Pokegama quartzite
Lower Huronian	1. Granite (intrusive)
	2. Slates, graywacke, conglomerates
(Unconformity)	
Archean basement complex	greenstones, gneisses, schists

The rocks comprising the district belong chiefly to the pre-Cambrian series, and consist for the most part of ancient granites, schists, gneisses, slates and quartzites. The geologic column for the district has been determined to be as shown in the accompanying table.

Difficulties in Prospecting

The iron ores occur entirely in the Biwabik, or iron-bearing series, probably of upper Huronian (Ordovician) age. As shown in the column, the upper Huronian consists of: (1), Virginia slates; (2), iron-bearing series; (3), Pokegama quartzite. The iron-bearing series comprises ferruginous cherts (taconite), ferruginous slates and schists, paint rock, sands, conglomerates and iron ore. The ore and taconite usually lie upon the Pokegama quartzite and are in part overlain by the Virginia slate, although the largest orebodies are found where the slate has been removed by erosion. Everywhere the formations are overlain by a mantle of glacial drift which sometimes attains a thickness of 100 ft. and renders prospecting entirely dependent upon drilling. This drift consists of sand and gravel intimately mixed, and often containing boulders weighing several tons. The ore occurs in beds from a few feet to 300 ft. thick, and occupies broad, shallow troughs. It is generally believed to have originated from the alteration of the mineral greenalite, a silicate of iron, by percolating waters under surface conditions. The original greenalite mineral probably accumulated on the bottom of an ancient Archean sea which once covered a considerable portion of the region. The primary source of the iron which was carried to the sea in the waters of streams was in the ancient igneous rocks which lie to the north and which still contain comparatively high amounts of iron.

Ore Is an Altered Taconite

The ores consist of slightly hydrated hematites which are often quite soft and unconsolidated, although in some of the

deposits they attain great hardness. They are of far greater horizontal extent than vertical and usually occur close to the surface. This fact has been of tremendous importance in mining the ores for it has made possible the use of openpit methods of mining with steam shovels. The ores are almost always closely associated with the taconite or ferruginous chert of the Biwabik formation, and the contact between the ore and this rock is extremely irregular and shows the ore to be an alteration product of the taconite. In places there are tongues of good ore extending out into the taconite, and again lenses of unaltered taconite project into the ore, and in many places taconite occurs in isolated "horses" completely surrounded by ore. Where this condition exists it renders steam-shovel mining impracticable if not impossible, and raises the cost of extraction.

All Exploration Done by Drilling

Exploration work is done entirely by drilling. Both churn drills and diamond drills are used, most of the work being done by contract. There are several exploration companies in the field prepared to do this work. The contract prices for drilling vary from $3 per ft. in drift and ore to $6 per ft. in hard rock where diamond drills are required. There are few geological guides to tell the prospector where to drill, and where ordinarily the geologic structure would furnish valuable hints, this structure is usually obscured on the Mesabi by the covering of gravel. Consequently, drilling is done by systematically surveying the property into squares, usually 100 or 200 ft. on a side, and putting down holes on the corners of these squares. If the first two or three holes do not show indications of ore, all of the squares are not drilled. If ore is encountered, each adjoining corner is drilled, and a rough outline of the shape of the deposit may be obtained by connecting adjoining holes which showed ore. The drillings are sampled every five feet, so that a complete record of the variation in the vertical limits of the deposit is obtained. The United States Steel Corporation spends yearly in Minnesota alone nearly $1,000,000 in exploration, which consists mainly in drilling. During the period of 1901 to 1909, inclusive, this company put down drill holes with an aggregate length of 229 miles.

Scope of the Openpit Method

The methods of mining in use on the Mesabi differ essentially from those employed on the other ranges in the Lake Superior region, for here the openpit method is developed to the greatest extent. Where the deposits show sufficient horizontal extent; where they lie comparatively near the surface and are free from projecting ledges of rock, and where the covering of drift is not too heavy, the openpit method may be most profitably employed. Where conditions are otherwise than above, underground methods will usually be adopted. There is one important factor to offset the advantage of openpit methods, and that is the tremendous initial capital required for stripping; and the interest on this capital, before a single ton of ore can be produced; for obviously, where this system is to be used, the overlying drift must all be removed before mining operations may begin. In the case of many of the large properties, operating on the openpit system, from two to three years are required to complete the stripping and put the mine in shape for the most economical mining. This has probably been the reason for many of the smaller mines in the district using underground methods. Some of the properties which began as underground mines are now changing to the openpit system, and not a few pits may be seen, with the old drift timbers visible in the ore bank.

Costs About 30c. Per Cu. Yd. to Strip

Most of the stripping is done by contract. The prices for contract work range from 25 to 35c. per cu.yd., and will average about 30c. In stripping it is estimated that it will pay to remove about two feet of drift for every foot of ore thus uncovered. In other words, it will pay to strip 100 ft. of drift, if by so doing, a deposit of ore 50 ft. thick is laid bare.

Since the Mesabi range was opened there have been 126,531,000 cu.yd. of stripping removed. Last year the United States Steel Corporation handled 22,000,000 cu.yd., and other companies about 8,000,000 cu.yd. The magnitude of these operations will be better realized by making a comparison with the work being done on the Panama canal, where the material is handled in a similar manner. The estimated total material to be removed in the construction of the Panama canal is 174,666,595 cu.yd. The central division, containing the Culebra cut, consists mainly of dry digging, while on the Atlantic and Pacific divisions, the bulk of the excavation is done by dredging. Up to date, the amount of materials removed on all divisions amounts to 94,969,388 cu.yd. On the Mesabi range the surface stripping by all companies to date has been 126,531,000 cu. yd.; the equivalent in bulk to 195,700,000 tons of ore is 97,580,000 cu.yd., making a total already removed of 224,381,000 cu.yd.

For the year 1909 on the Mesabi range, the surface stripping by all companies was 30,000,000 cu.yd.; the equivalent in bulk to 28,174,100 tons of ore was 14,087,050 cu. yd.; making a total of 44,087,050 cu.yd. In the Panama canal work, the total material removed in 1909 was 35,142,014 cu.yd. From the above figures it will be seen that the total material already handled on the Mesabi range is greater than the total material estimated to be removed in constructing the Panama canal; and furthermore, the material removed each year is greater in amount than the yearly yardage handled in the Canal Zone.

Proportion of Openpit Work

It must be remembered that 50 per cent. of the high-grade ore on the Mesabi range will have to be mined by underground methods. In many cases the overburden contains quicksand, made wet and treacherous by the accumulation of water, and it is necessary to sink concrete shafts in order to reach the ore below. Both the Morton and Scranton mines are sinking concrete shafts in ground of this character at present. This greatly increases the expense of development and adds to the time required before production may begin.

Toward the western end of the Mesabi range there are extensive orebodies mixed with sand. These are too low grade to ship direct, so they are subjected to a washing process to remove this waste material. A washing plant has recently been completed by the Oliver Iron Mining Company, located at Coleraine, Minn. This plant is at present capable of handling 5000 tons of crude ore per day, but provision is made for a much greater capacity.

Many of the mines on the Mesabi are leased to operators who mine the ore on a royalty basis. The royalties vary from 25c. or less, to a dollar per ton; the higher figure representing some of the more recent leases. The State of Minnesota owns in fee a large number of properties on the Mesabi range. The aggregate tonnage of merchantable ore in these as shown up by exploration, is, according to the State Tax Commission, 137,495,000 tons. When these ores are developed they will mean a large revenue to the State.

It has been estimated that there are 60,000 people directly dependent on the iron-mining industry of the Mesabi range; 8000 on the Vermillion range; and about 12,000 connected with the ore-carrying railroads, ore docks, exploration work in other parts of the State, or general offices of mining companies. This gives a total of about 80,000 people dependent mainly on the iron-ore industry of Minnesota.

Transportation of the Ore

Five railroads tap the iron ranges of Minnesota. These are: (1), Duluth & Iron Range; (2), Duluth, Missabe & Northern; (3), Great Northern (Missabe Division); (4), Northern Pacific (through the Cuyuna district); and (5),

the Soo, recently built to tap the Cuyuna range.

In 1884 the Duluth & Iron Range was took on the first cargo of Vermilion range. This is the pioneer ore-carrying road in the State. Six years later the Duluth, Missabe & Northern carried the first ore shipped from the Mesabi range. Later the Great Northern entered the Mesabi country near what is now the city of Hibbing. The distance the ore has to be carried varies from 70 to 100 miles. The average haul from the Cuyuna range will be about 100 miles. The following figures give the general equipment of the ore-carrying roads necessary for the handling of the enormous yearly tonnage: Duluth & Iron Range, 168 mi., 94 engines, 5247 cars; Duluth, Missabe & Northern, 284 mi., 92 engines, 7178 cars; Great Northern (Missabe division), 250 mi., 46 engines, 4300 cars.

In order to load the ore into boats at the least expense and in the shortest time possible, the railroads have established immense ore docks at the shipping ports. These docks are built so that trains of ore can be dumped directly into the pockets and several boats loaded from these pockets at the same time, by means of chutes. Some of these docks have cost about $1,000,000, and each road has from three to six. The sizes of the docks are given in the accompanying table:

ORE DOCK STATISTICS.

Dock.	Length, Ft.	Width, Ft.	Capacity, Tons.
Duluth & Iron Range, ore docks at Two Harbors.			
1	1388	49	40,400
2	1280	49	41,600
3	1054	49	34,000
4	1012	49	36,960
5	1050	49	35,450
6*	920	53	43,246
Total	....	..	231,656
*Steel dock.			
Duluth, Missabe & Northern, ore docks at Duluth			
2	2336	49	69,120
3	2336	59	80,640
4	2336	57	119,274
Total	....	..	269,034
Great Northern, ore docks at Superior, Wis.			
1	2244	62⅔	100,980
2	2100	62⅔	94,500
3	1956	62⅔	88,020
Total	....	...	283,500

THE ORE-CARRYING FLEET

An ordinary size boat of 8300 tons is usually loaded in six hours. The steamer "Wolvin" was loaded at Superior with 10,245 gross tons of ore in 1 hr. 29 min. (actual time of loading). There is a fleet of 550 boats on the Great Lakes to transport this ore to Lake Erie points and to South Chicago. Here it is reloaded and shipped to the furnaces. The first boat loaded with Minnesota ore was the steamer "Hecla." In 1884 this vessel took on the first cargo of Vermilion range ore, consisting of 1427 tons. An idea of the size of the newer ore boats may be had from the following: "Thomas F. Cole," 605 ft. long, 58 ft. wide, 12,000 tons capacity; "L. S. DeGraff," 605 ft. long, 60 ft. wide, 12,900 tons capacity; "W. B. Kerr," 605 ft. long, 60 ft. wide, 12,300 tons capacity.

Much of the finished iron and steel manufactured from these ores comes back to Minnesota and the growing Northwest. It will be only a few years before Minnesota will be manufacturing her own steel from the ores mined in the State. Work has already been started by the Minnesota Steel Company on a new $10,000,000 steel plant at West Duluth, and the work will be rapidly pushed to completion. This will save much transportation and with the opening of the new plant, many of the ore boats of the Great Lakes fleet will doubtless have to seek other cargoes.

Calumet & Arizona and Superior & Pittsburg Reports

The reports of the Calumet & Arizona and the Superior & Pittsburg companies, operating copper properties in the Bisbee district of Arizona, for the year ended Dec. 31, 1910, are the last to be made before consolidation. The Calumet & Arizona company produced 14,015 tons of copper in 1910, which sold at an average price of 12.9316c. per lb. The Superior & Pittsburg produced 13,067 tons of refined copper under the same price conditions. The silver and gold contents in the two bullions were $18.93 and $17.98 per ton respectively.

The Calumet & Arizona was originally capitalized at 250,000 shares at $10 per share, of which 200,000 were issued, while the Superior & Pittsburg was capitalized at 2,000,000 shares at $10, of which 1,500,000 were issued. Under the agreement for consolidation, the number of shares in Calumet & Arizona was increased 650,000 at $10 each, one of these shares to be exchanged for 3½ Superior & Pittsburg shares. In addition a special dividend was to be allowed the holders of the Superior & Pittsburg stock, this distribution amounting to 86c. per share. Calumet & Arizona paid $800,000 in regular dividends during the year.

The Calumet & Arizona company did 30,850 ft. of development during the year, divided as follows: Stations, 152 ft.; drifts, 23,378 ft.; raises and winzes, 7225 ft.; sinking, 95 feet.

No new orebodies were opened up in the Irish Mag shaft during the year, but promising extensions of previously mined areas were found. In the Oliver shaft new bodies have been found and old ones extended.

The corporation has been taking an advanced stand in suppressing Sunday labor, as far as it can be done. A bond has been taken on the Superior mine, in the Lordsburg district, and about 55 tons per day shipped after October to Douglas. The ore is silicious and is used as a converter lining. The Courtland and Copper Giant explorations have been discouraging.

The Superior & Pittsburg did 27,847 ft. of development work, of which 23,806.5 was in drifts; raises, 3511 ft.; sinking, 383 ft.; stations, 126 ft.; and winzes, 20.5 ft. Developments in the Junction shaft are stated to be most encouraging, both in regard to size and tenor of orebodies. During the year 1910 the Superior & Pittsburg pumped 1,516,014,750 gal. of water from its mines, of which 1,354,000,000 came from the Junction mine. New direct-connected plunger pumps will probably be installed here in the near future.

The smeltery of the Calumet & Arizona consists of four furnaces 44x300 in. and two 44x180 in., rated at 500 and 300 tons per day, or a total capacity of 2600 tons per day. As the percentage of sulphides in the Bisbee ores is constantly increasing, it is a question whether to remodel the present plant or to build a new one. Three of the 500-ton furnaces give as much gas as the dust chamber and stack should be called upon to handle, and when producing a low-grade matte to give the maximum economical copper recovery, the converters are also run to capacity. Experiments have been made with basic-lined converters, but the tests are not yet conclusive. Raw-sulphide smelting was also tried, but extensive alterations in plant, such as casting machines for low-grade matte, etc., would be required to make this successful commercially.

Allouez Mining Company

The Allouez Mining Company, operating copper mines in Michigan, reports a production of 4,655,702 lb. of copper in the year ended Dec. 31, 1910, at a cost of 11.57c. per lb., compared with 13.39c. for 1909, and 16.81c. in 1908. The pounds of refined copper recovered per ton of rock in 1908, 1909 and 1910 were respectively 13.80, 15.93 and 18.84, and the costs of mining and milling, $2.051, $1.806, and $1.769 per ton of rock.

The shafts were sunk 175 and 275 ft. during the year and are now 3118 and 2990 ft. deep. There were 6759 ft. of openings made. Owing to excessive wear on the rails of the curved shaft of this company, No. 1 shaft was closed for three months of the year, during which time 60-lb. rails were laid and the timbering strengthened.

Net profits for the year were $71,096, all of which was applied to the liability balance of Dec. 31, 1910 ($142,417), which leaves a net liability balance of $71,321. The financial statement of the Lake Milling, Smelting and Refining Company, a corporation owned by Allouez and Centennial, has already been commented on in connection with the report of the Centennial company.

Coal Mining Department

The Important News Of Coal Mining, New Appliances, New Methods, New Fields, Colliery Engineering

Coal Exports from United States

Coal and coke exports from the United States in 1910 aggregated $45,000,000 in value, and in addition to this, more than $20,000,000 was supplied to vessels engaged in the foreign trade, making a total of $65,000,000 worth of coal passing out of the United States during the year. In 1900, the total value of coal and coke exported (aside from that supplied to vessels in the foreign trade) was about $23,000,000; 20 years ago, about $7,000,000 and 30 years ago about $2,000,000. About one-third of the $45,000,000 worth of coal exported, or say, $15,000,000 in round terms, is anthracite; about $27,000,000 is bituminous and about $3,000,000 worth is coke. Of the anthracite exported in 1910, all but about $250,000 worth went to Canada. Of the bituminous, about $18,000,000 went to Canada, and $2,500,000 worth to Cuba; more than $1,000,000 worth of bituminous went to other West India islands. Only about 4 per cent. of the anthracite coal produced in the United States is exported, and about 3 per cent. of the bituminous coal production is sent to foreign countries.

The Indiana Employers' Liability Law

INDIANAPOLIS CORRESPONDENCE

Perhaps the most drastic employers' liability law ever passed by any State, with the exception of Oregon, was placed on the statute books of Indiana on the last day of the recent session of the legislature. The real significance of the measure, apparently escaped notice in the rush, and now it is found that practically every employer of labor is included in its sweeping provisions. It is in effect a compulsory compensation measure, and if upheld by the Indiana courts will force employers to rely wholly upon such protection as is afforded through liability insurance at considerable cost. Especially will the law work a hardship on mine operators since it prohibits or renders void any contract made by a miner or other employee to assume the risks of his employment. The introduction of electricity in the operation of a mine is likely to be retarded since this law makes a distinction for employers operating plants by electricity, as the requirements, it is claimed, are almost impossible of execution in a coal mine. The law provides for a fine of from $10 to $500 for each violation of any of its provisions.

In addition a separate senate bill, soon to become a law, renders an employer of miners, or of other laborers, liable in damages to the miner with little or no right to a defense in court; since this law practically cuts out contributory negligence on the part of employees as a defense.

Proposed Mine Laws in Pennsylvania

The proposed new bituminous mine-code bill that has been introduced in the legislature of Pennsylvania, embodies numerous important changes in the present law. According to the proposed bill, every gaseous mine opening after the passage of the act shall have at least four main entries, two of which shall lead from the main entrance, and two from the second opening into the body of the mine. Every new projected gaseous mine which will open a large acreage with main entries 5000 ft. or more in length, shall have at least five main entries. New nongaseous mines shall have at least two main entries. Stairways must be inspected every 24 hours. The hoists for employees must not be operated at a speed to exceed eight miles an hour.

Telephone communication between the top and bottom of every shaft or slope must be provided where persons or materials are lowered or hoisted. The speed of the cage is not to exceed 900 ft. per minute.

In every mine where explosive gas is generated, the foreman must employ shot-firers. No holes shall be fired by any person other than a shot-firer. They shall use no explosive except permissible explosives and shall use nothing but incombustible material for tamping. Electricity is to be utilized in firing the holes and all holes are to be charged, tamped and fired when all of the workmen are out of the mine except the shot-firers and other persons delegated to safeguard property.

In nongaseous mines, the minimum quantity of air shall not be less than 150 cu.ft. per min. for each person employed. In gaseous mines the minimum shall not be less than 200 cu.ft. per min. Open lights are prohibited where there is explosive gas. When both kinds of lamps are used in a mine, a suitable danger station is to be provided with an attendant whose duty it will be to prevent employees from one section going into the other, unless the attendant furnishes them with safety lamps.

Regarding mine inspectors, the new code specifies that the mine inspector shall be appointed by the governor, and the salary of each inspector is fixed at $3000 a year. Every inspector at the end of eight years' service shall have his salary increased to $3500.

Present and Future of the Anthracite Industry

The following statement of the present condition of the anthracite industry and forecast of its future, is of interest as coming from the report of the Delaware, Lackawanna & Western, one of the largest and most successful of the anthracite mining and carrying companies: "The condition of and outlook for the anthracite coal industry as a whole seem to be most satisfactory. With the growth of the population of the country the demand for domestic sizes is increasing steadily. Thus far this has resulted in recent years in the demand practically absorbing from year to year the tonnage produced, the producing companies not being able to accumulate any considerable stocks of coal. Whether, as the demand increases in the future from year to year, the production will be equal to the requirements of consumers is a question. Certain it is the older operations are fast exhausting the coal that has been available for their profitable mining and while new operations are being opened up from year to year by all the producing companies, it is at least doubtful whether the new ones will be able to produce sufficient coal to equal the decreased output of the older ones, which is inevitable in the future."

There are various methods whereby the average householder determines the quality of the fuel he is burning. The general plan followed is to inspect the ashes, consider the heat given off, the relative ease of burning and the freedom from clinkers. Such an examination is quite superficial and is not accurate. A better plan is to burn a certain weight of coal and measure the amount of water evaporated by its combustion. It is, of course, understood that absolutely accurate tests can only be secured by having a sample of the coal analyzed or better still, by having the heating value determined in a calorimeter.

Fires Due to Electrical Cables

By Sydney F. Walker*

Precautions to be observed in the installation of armored cables, and some causes that lead up to disastrous shaft fires.

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The contractor who was responsible for fixing the plant, cables, etc., in the colliery, as described in "An Incident in Colliery Electrical Work" in the ENGINEERING AND MINING JOURNAL of Nov. 12, appears to me to have been distinctly asking for trouble. One of the first things which I learned, when I commenced to fix electrical plants in collieries 34 years ago, was that colliery folks knew but little about electrical apparatus, and that the whole of the appliances required careful supervision while being fixed, and close attention afterward. In those early days the apparatus that was applicable to colliery working consisted only of electrical signals, while today the leading collieries are worked to a large extent by means of electrical apparatus; however, the same reasoning holds.

While there are a number of colliery engineers today who have a good knowledge of electricity, sufficient to look after electrical apparatus, to see that cables are properly fixed and in many cases to discover faults when they arise, the great bulk of colliery engineers have not that knowledge. With the majority of colliery engineers there is the same comparative want of knowledge today, bearing in mind the largely increased use of electrical apparatus, as there was 34 years ago. At the period when the 300-kw. plant mentioned in the article in your issue of Nov. 12 was fixed, there certainly was but little knowledge indeed of cables, and of electrical apparatus generally. Certainly at the period when the plant in question was fixed, few colliery engineers would have any knowledge of the properties of paper-covered cables. At that period probably very little paper-covered cable had been used in collieries at all.

It is only since high pressures have been employed in collieries, 2000 and 3000 volts, that paper-covered cables have been used largely in colliery work. In those days there were a few collieries that experimented more or less in all kinds of cables, and apparently there were a few contractors who believed in paper-covered cables. Attempts were made to introduce jute-covered cables into collieries from time to time, as far back as 20 years ago, but they were almost universally unsuccessful.

A Criticism

The idea expressed in the article that "it would seem to be almost incredible that anyone should imagine a cable subjected to such treatment, should be expected to stand up to its work in a downcast shaft, whose walls were covered by a trickle of water and whose atmosphere was thoroughly damp," appears to me to be exceedingly absurd. How were colliery engineers to know that a lead-covered cable would not stand the treatment that they put it to. At about the same time this cable was being fixed in the shaft in question, colliery engineers might have seen somewhat similar cables being laid under the streets, and being subjected to very much rougher treatment than they gave to the cable they fixed. Unless they were carefully instructed in the matter, there was nothing to tell them that the stripping of the lead covering rendered the cable useless, and was likely to lead to the disastrous results that followed in this case.

Cause of Careless Work

To my mind, one of the great difficulties in connection with the use of electrical apparatus in mines lies in the fact that electrical engineers are so unfamiliar with mining conditions. To them the conditions underground are exceedingly uncomfortable. The conditions are not unlike those of a landsman on board ship. When repairs are to be made, the electrical man wants to get them done as quickly as possible, and get away out of the pit again. It leads also to carelessness in work, and to the avoidance of work that ought to be done. In the case in question, the contractor ought to have carefully instructed the colliery engineers in the properties of the paper-covered cable, and should have explained to them how fatal it was for the lead covering to be damaged, and above all things, when he found that the cable had been fixed in the shaft, he should have had the covering of the boxes removed, and have examined every inch of it with as good a light as he could get before turning current onto it.

Even if he supposed that the cable itself had not been damaged in fixing, the question of the joints surely required attention. The cable, we are told, was a three-core cable, such as is used for three-phase work, and that there were two joints in the shaft. The jointing of three-cored lead-covered cable is an exceedingly difficult operation, and particularly so in a wet shaft. It is necessary that the lead covering shall be cut back on each side of the joint over a sufficient length to enable the joints in the three cables to be made in such a position that they cannot touch each other. It is necessary that, as far as possible, and this is a most difficult matter in a wet shaft, water shall be kept out of the joints, and it is then necessary that the whole thing shall be closed in by the equivalent of the lead covering itself. At the time the plant was fixed probably the joint boxes that are now commonly employed were not on the market, and the joints would be more or less of a makeshift. To cheerfully entrust the jointing of three-core lead covered cables to colliery engineers, who had presumably never seen a paper-covered cable before, was tempting Providence with a vengenance.

Discussion of Cable Coverings

Probably a little explanation of the properties of the paper-covered cable and the three-cored cable used for three-phase work may be of assistance. Paper is largely taking the place of india rubber as an insulator for two reasons. It is much cheaper than india rubber and its resistance to sparking is higher. Further, for a number of years past, as I think I have explained in some previous articles in the ENGINEERING AND MINING JOURNAL, it has been difficult to insure that good rubber was used for the insulation of cables. Up till recently, there were two classes of rubber on the market, known as "Para" and West African. "Para" was worth five times as much as West African. A cable insulated with rubber containing 30 per cent. of Para stood well, but it naturally cost considerably more than a cable insulated with West African. The cable insulated with West African lasted but a short time.

There was nothing, however, to show the difference, and no test that has yet been devised will show the difference, when the rubber has been laid on the cable, between Para and West African. Hence for street work, where high tensions early became the rule, paper-covered cables were introduced some 20 years ago, and some mines followed them at a comparatively early date. But paper is only an insulator as long as it is dry. Paper is porous, and readily absorbs moisture. Dry paper offers a high resistance to leakage currents, and to sparking. Wet paper offers but little resistance at all to leakage. To meet this difficulty, the paper that is employed for the insulation of cables is impregnated with resinous oils, either before it is laid on the conductor or afterward, and to insure that moisture shall not reach the paper it is inclosed in the lead tube. If any damage occurs to the lead tube, and moisture enters, the insulation of the ca-

ble quickly deteriorates. So important is this feature that the ends of paper-covered cables are provided with caps when they are sent out on their drums, the caps insuring that moisture shall not reach the exposed ends of the paper insulation.

In the three-cored cable usually employed for three-phase work, each conductor is separately insulated with paper, or whatever the insulating substance employed may be; the three insulated conductors are then stranded together, insulated outside of all, "filling" being employed between the cables, and the whole drawn into a lead tube, if the insulation is paper. Conductors employed for three-phase work must not be made separately, must not be drawn separately into lead tubes, as a separate lead covering lowers the efficiency of the cable, owing to the currents that are set up in it by the changes in the alternating currents passing in the conductor.

The effect is considerably increased if the cables are armored, as changes of magnetism are set up in the armor. The arrangement of the three cables stranded together, and drawn into a lead tube, is the best for the efficiency of the cable. With three-phase currents, what is called mutual induction takes place between the currents passing in the three conductors. Mutual induction means a charge upon the power delivered to the cable, and this is least when the construction described, the three cables stranded together, is observed.

This construction, however, it will be easily understood, renders the cables liable to short circuits, as they are termed, to connections between the individual conductors, or between the conductors and the lead covering, in case of damage to the lead covering. In town work, many a cable has been damaged by a navvy driving the point of his pick through the lead covering. In the case described in your issue of Nov. 12, the stripping of the lead covering off the conductors provided all the material for connection between the conductors. Even a pinhole in the lead covering has sometimes led to a breakdown of a cable later on, and the removal of a large portion of the lead, provided large facilities for breakdown.

What Leads to Disaster

When the paper insulating envelop is exposed to the atmosphere, and particularly in a pit shaft where water is always running down, the insulating properties of the paper are quickly lost. The oil is soon washed out, or diluted to such an extent, that a considerable leakage current passes across from one cable to the other. In the three-phase system, it should be mentioned that each two of the conductors in a three-core cable form a circuit, just as the two cables of a continuous-current service do, so that the breakdown of the insulation between any two of the conductors will cause a short circuit between them. With paper-covered cables, once a leakage current is started, the leakage current itself will make matters worse. The leakage current would tend to drive out the oil and to gradually carbonize the paper, and at some favorable moment, say when a large current was switched off, a spark might pass from one conductor to the other, setting fire to the paper, and possibly to the oil.

The first spark would probably be followed by an arc, because it would burn away a certain amount of the insulating envelop, and there being plenty of power in the generator on the surface, and plenty of pressure, an arc would be thrown across the space where the spark had previously passed, and a good fire would easily result. In the case in question, the spark probably passed when the motor was shut down, after running up. It is a peculiar feature of the distribution of electrical currents that when a large current is suddenly switched off, the pressure at all parts of the service immediately rises to a considerable extent, for a very short interval. Faraday called the phenomenon, the extra current. It leads in numerous instances to sparks passing through insulating material that has been supposed to be impervious to sparking, and the spark is often followed by an arc.

Fixing the Cable in Shaft

I have only one other remark to make in connection with this matter. The arrangement of fixing the cable in the shaft was good, provided certain precautions were taken to render the wood boxing waterproof. The support of cables in a shaft is one of the most difficult, and one of the most important problems that the electrical engineer engaged in mining work has to tackle. It is of particular importance in connection with paper-covered cables inclosed in lead tubes. If any considerable lengths of the cable are suspended in the shaft, experience has shown that the oil with which the paper is impregnated, tends to run down inside the lead tube, leaving a space above filled apparently by gas formed from a portion of the oil with which the paper there was impregnated. In course of time the pressure of the gas above, and the weight of the oil below, has been known to burst the lead covering. In addition to this, there is always the danger of the lead covering being cracked by elongation, if too long lengths are suspended in the shaft.

The very best method of fixing any cable in a shaft, is by having boxes supported by the buntons, or by the brick work of the shaft, the boxes being just sufficiently large to allow of the cables being tapped into them. The cables are then supported by friction the whole way down. Unfortunately there is one serious drawback to this method. If untreated wood is employed for the boxes, it quickly becomes saturated with water, like a sponge. And the water held in the pores of the boxing being in the very best position for attacking the lead covering, trouble often results, as pit water nearly always contains salts in solution. By impregnating the boxing with one of the compounds on the market, which render it nonabsorbent, and at the same time noninflammable, this difficulty is overcome. Failing the use of one of these compounds, well tarring the inside of the boxes, and tarring them again periodically, will accomplish the same effect to a great extent.

New Gathering Locomotive

A new type of gathering locomotive has recently been furnished one of the large anthracite-coal companies by the Westinghouse company. The locomotive is known as the Baldwin-Westinghouse type. It is particularly applicable when the conditions of the labor require that the empty car be delivered to the face of the room, and the loaded car taken therefrom; the locomotive is also useful where the rooms are driven to the rise and to the dip.

The cable is pulled out against the torque of a small motor arranged to drive the reel; when the locomotive is returning to the entry, the torque of the motor automatically winds up the cable, obtaining its power, along with that for the locomotive, through the cable as it is wound up. Arrangements are provided whereby the pull on the cable is constant, regardless of the direction in which the locomotive is traveling. Another feature is that the pull does not vary with the speed of the locomotive, and, consequently, there is no danger of running over the cable.

A wire-rope traction wheel is used where the rooms are driven to the dip at too heavy a grade for the locomotive to enter. The rear end of the locomotive is then stopped opposite the mouth of the room and a small steel-wire rope is pulled down to the face and attached to the loaded car. The motorman then cuts out one of the locomotive motors by means of a switch, and with a clutch detaches the motor from the axle and attaches it to the cable reel.

The Alby United Carbide Factories reports that the Northwestern Cyanamide Company's plant in England, in which it is a large stockholder, is now producing 12,000 tons of cyanamide per annum, but that the demand for the product is so great that it will immediately be enlarged to 16,000 tons per year. Works with a capacity of 6000 tons per annum have been erected at Vilvorde, Belgium, to convert cyanamide into ammonia.

Report on Surface Caving at Scranton

Scranton Correspondence

Removal of the coal seams under the city of Scranton has greatly endangered lives and property. Engineers appointed to find a solution for the problem report the situation as serious and suggest remedies.

Two years ago a subsidence of the surface took place in West Scranton, Penn., which was of such a serious and extensive character that the public authorities, city council, school board, board of trade and private individuals having a large financial stake in the city of Scranton, and even those whose only real estate consisted of a home, became seriously alarmed; the West Scranton cave-in wrecked one public school, damaged another more or less seriously and engulfed two or three private houses. The area of the sinking covered many acres, yet this subsidence was the result of the settling in the workings or ramifications of one mine alone, the Oxford colliery, which is located in West Scranton, but is practically in the heart of the city. West Scranton is divided from the central city by the Lackawanna river, although for conventional topographical distinction, this section forms a suburb by itself.

After various consultations with John Hays Hammond and some of the leading mining engineers of the country as to what had best be done, an ex-mayor of Scranton, J. Benjamin Dimmick, secured an appropriation from the city council and the school board to the amount of $10,000 for the purpose of having a survey made of the workings of the mines of Scranton, those actually in operation, and, as far as practicable, the workings of those that have been exhausted.

To make this survey, two expert mining engineers, Eli T. Connor and William Griffiths, men who were thoroughly familiar with the mines of Scranton, were delegated to make the survey. They were occupied in this work four months and the result of their observations and conclusions has been published in a voluminous report which has just been made public. The gist of their report is contained in the summary, an abstract of which follows.

Summary of Report

The report is accompanied by an atlas containing a full set of plans of the city and mine workings thereunder, and also cross-sections showing the positions of the several beds of coal and the intervening strata, from which can readily be determined, at almost any given point, the depth of coal beneath the surface, the thickness of the beds and the thickness of the intervening strata, as all the plans are drawn to scale. As provided for in our contract, these plans are based upon information obtained from the maps, records and data loaned to us by the several mining corporations, the Pennsylvania Geological Survey of 1885 and from our own personal investigations and measurements.

After about 40 days of careful inspection of underground conditions of all of the collieries operating within the city limits, we find that the total quantity of coal and refuse that has been extracted from under the city of Scranton is about 221,000,000 tons. There has been produced for market from 27 collieries 177,000,000 tons of coal. The space excavated under the city is about 198,000,000 cu.yd. The total estimated excavation of the Panama canal is about 174,666,594 cubic yards.

It must not be understood that the territory from which the above material has been excavated is still open. It is, of course, impossible to say what percentage of the space excavated remains open, but we believe that it does not contain half the original, due to numerous squeezes and cave-ins that have occurred and closed the openings.

Conclusions Reached

While some other devices are locally useful, the only methods that combine the requisites of strength, ease of application and reasonable cost, are by filling the underground openings by what is known as the flushing method, using for the purpose culm, sand, crushed rock and other fine materials that can be washed into the mines with water.

This method originated in the anthracite mines of Pennsylvania and has been extensively adopted in European mines where, at great expense sand, loam and crushed rock are filled into the mines, following the removal of the coal by the longwall method of mining. We, therefore, offer as our only recommendation, that the flushing method be adopted under the plans and specifications contained in our report. The following conclusions are drawn:

(1) That, speaking broadly, the service of the city can be protected by the methods recommended and at a cost not in any sense prohibitory when considered with its relation to the value of the property and the activities for which the support is absolutely essential.

(2) That while there are points in the city, as indicated in the detailed report, where, at the present time, in our judgment, there is distinct and immediate danger to life and property, yet the total of such area immediately threatened constitutes only about 15 per cent. of the entire area of the city, mainly from surface depth.

(3) On the west side of the city, the middle series of beds are thick and close together, and the pillars not columnized, creating a dangerous situation where the workings have not been closed by previous caves. Particular areas thus threatened are not particularized on account of the inaccessibility of much of the mined-over area. Detailed investigation should be made of the portions of the mines not already closed. Relatively we do not believe that a large part of the territory mentioned is threatened, on account of much having been previously closed by caves. Special attention is called to conditions under schools Nos. 12, 23 and 29. They should be promptly attended to.

The lower series of beds, namely, the three Dunmores are so thin and so far below the surface that with the usual system of mining we do not think that they constitute a serious menace to the improvements on the surface, excepting along the margin of solid blocks of unmined coal and near the outcrops. In the deep Dunmore beds, therefore, we believe these solid blocks should be mined.

(4) It would seem, therefore, to be not only the part of wisdom, but absolutely obligatory to at once commence to give support to the points menaced and thereupon proceed upon a general policy of giving support to the entire area of the city, for it must be borne in mind that, with the mines, activities are constantly going on; other and additional points of danger are not only liable to occur, but in all probability will occur with each passing year, it might be said almost with each passing month.

Coal Removed Will Pay for Filling

(5) Where the owner of the surface has undoubted rights to support thereof by coal pillars, in our opinion he could permit the removal of such pillars, and the value thereof would, under average conditions, pay for such artificial support as we have recommended, assuming that the pillars were mined and the support constructed by the same operating company. This observation is, however, based upon the assumption that in such case the operating company is one of the large transportation companies, inasmuch

as while there might not be a profit in the immediate transaction of mining the pillars and installing the support, there would be, of course, a profit to such companies in carrying the coal to market.

(6) Culm flushing should be used only in coal beds having a light cover, up to 200 or 500 ft., according to the amount of settlement expected. But sand, being four or five times as strong as culm, is best suitable for all beds under Scranton and should be preferred.

(7) We believe that the conditions adduced from the tests made, and the calculations and tabulations based thereon, are reasonably reliable; yet, we desire to record the opinion that there are conditions existing in the mines where they might not apply. For instance, in locations where several seams of coal are separated by a thin stratum of shale and slate, or even sandstone, and the pillars in two or more seams are not over one another, and it is proposed reclaiming all or any part of the pillars.

Even although an application of our deductions might appear to fit the conditions, we believe that the only permissible procedure would be to first fill with flushed material all of the openings in the lowest vein of the series, and thence upward until all are filled, care being taken to have the flushed areas over one another. After all of the openings in all of the seams have been filled, the pillars in the uppermost seam may be attacked and, as each pillar is removed, the space should be at once filled. No pillar reclamation to be permitted in any of the beds until all of the pillars in the upper bed have been removed and the overburden has come to rest on the flushed material, after which the pillars in the next lower seam may be attacked and handled in like manner.

Harmony Essential to Success

(8) Harmonious plans and procedure between the coal companies, the city, the school authorities and the public are essential to the successful carrying out of any relief measures that are herein or may be hereafter suggested. It is a fact which should be evident to all that the property of the city and community is to a large extent dependent upon the coal companies, and that drastic laws or regulations that may curtail the mining of coal will necessarily react on the prosperity of the community and any ameliorating plans or compromises as between the city and the mining companies which it may be possible to effect tend to prolong the life of the mining industry in Scranton and vicinity and should be promoted.

It should therefore be the aim of all interested in mine-cave protective measures and the companies operating the mines to adopt plans that will best conserve the welfare of all concerned. The expenditure for the work would, of course, be distributed over many years, the relief being applied at the points most in need of protection and as rapidly as proper arrangements could be effected and the necessary details, surveys, etc., prepared.

A Protective Commission Recommended

For the businesslike carrying out of the plans suggested, it is recommended that a Protective Commission be established, consisting of not less than three or of more than five men, representing the city authorities, school board and coal companies; this commission to have full and complete authority for the execution of the plans approved by the proper legal action. The commission should employ an engineer as active manager of the work, who should devote all of his time to the service.

It will be observed from the summary that the engineers recommend the flushing of the mines under Scranton by what is known on the continent of Europe as the "Scranton system"; this consists in filling up the excavations by flushing culm, sand and small gravel into the mine. Although giving absolute and unqualified approval to this method as being generally suitable for deep as well as for shallow beds, the engineers say that it is not invariably applicable or convenient. There are many places, they say, where it may be preferable or permissible to use some other less efficient or less costly method of support, and, if for any reason flushing is not adaptable to any particular circumstance, they advocate what is known as "dry filling." Broadly, the engineers recommend that where flushing is not convenient or practicable they would substitute for the sustenation of the roof "gob piers" or that those lumps of rock that are blasted with the coal should be used for building piers to sustain the surface where there is immediate or approximate danger of a subsidence.

Further Recommendations

The engineers state further that it would be an admirable precautionary measure for the future to "blast roof and floor in thinner veins." They continue: "It is a well known fact that loose rock occupies from one and two-thirds to two times the volume of the same rock in place. In other words, if a cubic yard of solid rock be broken to pieces, the pieces will occupy a space equivalent to one and two-thirds to two cubic yards.

"Your engineers have conceived the idea of taking advantage of this engineering fact for the purpose of cheaply producing an adequate roof support for certain classes of coal beds under the city. So far as we know, the method in its entirety has never been used before in any coal-mining district and the suggestion is here made for the first time. The process would be applicable to seams less than 6 ft. in thickness and so located that the shock of blasting would not produce ruptures of the measures supporting the adjacent coal beds. It consists simply in blowing up the floor of the mine to a depth equal to the thickness of the vein and blowing down the roof of the mine directly over, to a hight equal to the thickness of the vein. This would produce a total thickness of loose rock equal to three times the thickness of the coal bed. It would be well packed together and have great supporting power, and withal be a comparatively inexpensive process."

COLLIERY·NOTES

France is Great Britain's best foreign customer for English coal, with Italy ranking second, and Germany third. Even Argentina takes about 3,000,000 tons of English coal anually.

Coaldust explosions show little violence near the point of origin unless originating from the ignition of a large volume of firedamp or from the discharge of a quantity of explosives.

It costs, on an average, about $2 per ton to mine coal in the South Wales field. Intervening charges for handling, and so forth, bring the present cost up to $4.38 on board ship at Cardiff. The freight rate to Rio de Janeiro is $4.14. The freight to Buenos Ayres and other South American ports is equally high, so that the coal reaches these ports c.i.f at from $8.50 to $9 per ton. It does appear from these figures that American coal should command this trade. The probable reason why coal from the United States has not secured the South American market is because of the lack of return cargoes. The shipment of wheat from Argentina to the United Kingdom gives the British ships return freight.

Out of 1,296,007 tons of coal imported into Chile during 1910, only 7260 tons came from America. Cardiff furnished 584,753 tons, while 426,861 tons came from Australia. According to Consul Alfred A. Winslow, Valparaiso, it appears that there is a fine opening for the sale of American coal in Chile. There is no question that return cargoes can now be obtained. The United States purchases large quantities of Chilean nitrate that are now being shipped in tramp steamers doing business with European ports. It will pay American coal interests to look into the matter of opening an agency at Valparaiso. Good prices are usually paid there for high-grade steam and coking coal. Present prices vary from $7 to $9 per ton, United States gold. There is no duty on coal now, but the mining interests of Chile are advocating placing a duty thereon, to compel a greater consumption of the native article.

Sampling Ores from Cobalt Mines

By F. W. Pugsley *

Ores from the Cobalt mines contain native silver, making accurate sampling difficult. The coarse metallics are removed, melted and cast in a bar which is sampled apart from the other portion of the sample. The fine ore is usually richer than the coarse, and local concentration in mixing is prevented by thorough sprinkling.

*Chemist and metallurgist, Perth Amboy, N. J.

In sampling high-grade ores from the Cobalt district many different schemes have been devised with more or less success, including both hand and automatic sampling. I shall confine myself to that used under my supervision.

Preliminary Crushing and Screening

The ore or jig concentrates are fed into a crusher, passing thence into a revolving screen of ¼-in. mesh, the oversize going to rolls and again to the screen, until the whole amount sampled has been broken so that the largest piece is ¼ in. in size. All nuggets of silver which are not broken are screened out, melted, cast in bars, sampled and assayed for fineness. In sampling, three holes are bored through each bar, one at the center and the others each two-thirds of the distance from the center to the corner of the bar. This material averages about 85 per cent. silver, there being some cobalt, nickel and arsenic alloyed with it; there is some segregation and the center of the bar is higher in silver than the outer edges. This method of sampling has been found to be satisfactory for determining the true value of the metallics.

Mixing and Dividing the Sample

The crushed ore is taken to a floor covered with steel plates, and dumped so as to form a ridge some 30 ft. in length; five men on each side start at one end and travel the length of the ridge, shoveling from the side and scattering the ore as they go into another ridge some three feet from the original. They pass back and forth until the original ridge is divided in two; the two ridges are then thrown back into one. This ridge is again cut in two as in the first case. This process thoroughly mixes the ore.

Each of the two ridges are then cut in two by the same method, making four ridges. These four ridges, containing the entire quantity of ore to be sampled, represent four samples to be made. A man now starts at each end of a ridge, placing one shovelful of ore on the floor behind him, and one shovelful in a bag, the bagged material being the reject. When the ridge has been traversed one-half is bagged and one-half is again in a ridge. The operation is repeated until each ridge is reduced to about one and one-half tons. This amount is coned, shoveled into a Jones divider and reduced to about 300 lb.—thus making four 300-lb. samples.

Final Grinding of Samples

Each sample is put through sampling-mill rolls and crushed until it all passes through an 8-mesh screen. In high-grade ores much metallic silver is left on the screen, which is ground in a metallic grinder until it all passes 8 mesh; the fine material is coned, flattened and the metallic silver carefully distributed over the surface. The sample is then shoveled into a circle, from the inside of which it is shoveled into a cone. It is circled and coned alternately three times, so as to mix thoroughly the metallics with the pulp. It is then cut on a Jones divider to about 40 lb., is again ground until all passes a 20-mesh screen, this being passed through a Jones divider several times for the purpose of again mixing the pulp and metallics, after which it is cut on a small riffle to about 1500 grams and placed in a drier for 12 hours, the final grinding to 100-mesh being done in a disk grinder. Formerly pebble mills were used, which often left as high as 75 grams of metallics to be assayed separately from the pulp. The disk grinder does the work much more rapidly, and seldom leaves more than one gram of metallics.

Assays of Samples and Resamples

This process of sampling takes about three days, and has been found to be an accurate method, it having been proved by resampling of different grades of material. The results of resampling are here given—the result of eight assays on the four original samples and eight assays on the four resamples: Jig concentrates, 1529 oz., 1527 oz.; Hutch concentrates, 264 oz., 263 oz.; Wilfley concentrates, 725 oz., 728 oz.; Wilfley concentrates, 925 oz., 924 oz.; high-grade ore, 2869 oz., 2854 oz.

The difference on the high-grade ore is the greatest, yet it will be observed that the difference is only a trifle over one-half of one per cent.

In sampling concentrates from Wilfley tables there was a wide difference between the high and low assays on the four samples, in some cases the difference being as high as 100 oz., the average on 16 cars being 66 oz. between high and low; this difference being considerably more than on high-grade ore crushed to pass a ¼-in. mesh screen. The concentrates coming to the sampling floor average about 0.2 per cent. moisture.

The Causes of Differences in Check Samples

Some time was spent in investigating and studying the cause of this difference in the four samples; it was found to be due to the coarse particles of lower grade separating from the fine richer material. The coarse particles were constantly rolling down the ridge, while the very fine material remained at the apex, and as the ridge grew in size a streak of rich concentrate formed in the center. In shoveling from each side of this ridge, if the men on one side shoveled faster than those opposite, the apex would break down in that direction, so at the finish, one of the ridges was richer than the other; the same thing happened again in cutting each of the two ridges into two more, so, by the time the four ridges were ready for the final cutting down, there was a wide difference in them.

Sprinkling to Overcome Concentration

To overcome this difference, sprinkling of the material before and during the first cutting was resorted to, in order to cause the fine particles to adhere to the coarse, and thus prevent them, to a large degree, from separating and rolling to the bottom of the ridge, and in case they did they would also carry along the fine particles. A favorable result of the sprinkling was apparent at once, and the difference between high and low assays on the four samples decreased 74 per cent., as on 16 cars treated in this way, the average between high and low was 19 oz. as against 66 oz. under the dry method of sampling.

It has already been mentioned that the high-grade ore, broken to pass the ¼-in. mesh, did not give so great a difference between high and low samples as the Wilfley concentrates, which average about 52 per cent. silica, while the high-grade ore averages about 7 per cent. silica, because, while the coarse particles in the sampling of high-grade ore were separated from the finer material, it did not materially affect the sample, as the coarse particles were of approximately the same richness as the fine, while, with the concentrates, the high percentage of silica is in the coarse particles, and the high metal contents in the fine.

Oil and Gas in West Virginia

SPECIAL CORRESPONDENCE

Harrison county shows a good deal of oil-development work under way, and next to Roane county is the most active. With the passing of the Shinnston pool, the new development in the Gordon sand in Sardis and Ten Mile districts is now attracting the most attention in this country. On Nolin run, Eagle district, the Hope Natural Gas Company has a small gasser on the L. S. Harbert farm. On Booths creek, Clay district, the same company has drilled on the R. L. Reed farm through the 50-ft. sand and has a fair gasser. On Elk river, Clendenin district, Kanawha county, the Clendenin Oil and Gas Company has tested its gasser on the Doctor Davis farm, and it shows a capacity of 9,000,000 cu.ft. a day in the Weir or Squaw sand. On the east bank of the Kanawha river, in Cabin Creek district, the Hamilton company has a 5,000,000-ft. gasser on a town lot. On the same stream in Big Sandy district the Clendenin company has built a rig on the Jarrett lot at Clendenin. On Coonskin run, Elk district, the Hamilton company has built a rig on the Barlow farm.

On Big Panther run, McKim district, Pleasants county, Walter Reeses and others on the E. L. Eddy farm, are into the Maxon sand and reported to have developed a strong gas pressure. This is purely a "wildcat," located several miles from any production. On McKim creek, Lafayette district, H. Wagner & Co. are drilling on the J. Wrick farm.

On Bond's creek, Clay district, Ritchie county, the American Hydroscope Company recently lost a bit in its deep test on the T. E. Dye farm at 4450 ft. When the bit was lost, the crew at work on the well lost its nerve and quit, claiming it was too deep for them. A. S. Vischer, president of the company, soon secured a new crew and made a contract to drill to a depth of 5100 ft. Ritchie county is showing more early-spring activity than any other lower southwest county. There is quite a good deal of inside territory that can furnish light producers and it is shallow as compared with other districts. On Long run, Grant district, the States Oil Company has completed No. 3 on the Hall-Tetrick farm and has a show for a 30-bbl. producer in the Keener district. On White Oak creek, near Oxford, Union district, the Nina Oil Company has drilled a test on the Black heir's farm through the Big Injun sand and has a light gasser.

On Green creek, Roane county, the United Fuel Gas Company has completed a test on the E. E. Mahon farm and has a light gasser in the Big Injun sand. On Hollywood creek, Geary district, the South Penn Oil Company has drilled its test on the Albert Hemrick farm through the Big Injun sand and has a good gasser. On Shaver fork, in the same district, the United Fuel Gas Company is due in the sand at a test on the Betty Damewood farm. On Hollywood creek the same company is down 1500 ft. at a test on the Philip Keene farm. The same company has six or eight other wells drilling or starting in Geary district.

One of the largest oil and gas deals ever made in West Virginia was recently closed by the purchase by the Echo Oil and Gas Company from the Twelve Pole Coke and Iron Company of several thousand acres of mineral land in Wayne county. This land is rich in both oil and gas and will be developed.

A new field has been found on Fishing creek, Wetzel county. The oil is found in the Gordon sand, and one 15-bbl. producer has caused much new work to start. In the Smithfield district, the South Penn Oil Company has drilled No. 21 on the H. L. Smith farm and has found only a little gas.

New Utah Railroads

SPECIAL CORRESPONDENCE

Two railroads are projected for eastern and southern Utah and, if completed, will lead to the further development of the mineral resources of these arts of the State, especially the coal lands. The Eastern Utah Railroad Company was incorporated recently to built a road from Wellington, Carbon county, to Emery, in Emery county, near the Sevier county line. The road will connect with the Denver & Rio Grande, at Wellington, and will run southwesterly for about 60 miles, passing through the extensive coalfields in Emery county which, on account of lack of transportation facilities, have received but little attention. Carbon county has been producing the greater part of the coal mined in the State for the last 10 years or more, but it is thought the Emery fields will produce generously with a proper outlet. Grading has been started between Wellington and Orangeville, the first part of the road being over relatively level country. The general route is along the old survey made by the Rio Grande Western about 20 years ago. Henry Wade, of Price, is president of the company.

The Utah & Grand Cañon Railroad, which is to open up a new section in southern Utah between Lund, on the Salt Lake route, and Knarraville, near the Washington-Iron county line, and which is to continue toward St. George and on to Searchlight, Nev., to connect with the Santa Fé, has acquired the right of way through most of the private property in its route and has applied to the Government for right of way over the Government land, through which it is to pass. Actual construction has been begun between Lund and Iron Springs, a distance of 20 miles. The road will pass in the neighborhood of large iron and coal deposits in this section. It is understood that the same company has made surveys for a proposed line between Marysvale, the terminus of the San Pete Valley branch of the Denver & Rio Grande, southeast to the Grand cañon.

Alamos District, Sonora

SPECIAL CORRESPONDENCE

E. G. Swayze and E. H. May, of Kansas City were in Alamos recently, completing the purchase of the Plata Fina mine in the Promontorios district. T. P. Brinnegar, in charge of the property, has let contracts for development, which will be pushed as rapidly as possible. G. W. DuBes, of New Orleans, is developing a silver property in the same locality. He has three shafts down to depth varying from 75 to 100 ft. in depth, and has installed steam hoists and pump.

At Sobia, 30 miles southeast of Alamos, Louis H. Wilson and J. L. Obermuller have completed their five-stamp mill and have it in operation, treating the free-milling gold ore from their Prieta mine. They have a shaft down 200 ft., and have a good body of medium-grade gold ore. Fred C. Tatum, of New York, is sinking three shafts on the Black Fox claim, and it is said is meeting with encouraging results. Daniel McKenzie is in charge. Charles W. Smith is operating a 10-stamp mill on ore from the La Junta mine owned by the Mexican company. The ore is mostly free milling, and it is said will average $40 per ton. The high-grade ore is being shipped.

At Matapaco on the Mayo river, 50 miles north of Alamos, Todd C. Woodworth, W. R. Layne and associates are developing a silver property of unusual interest. There are a number of veins from 20 to 30 ft. in width, the gangue being principally calcite and barite. They are plainly exposed on the surface, in one case for a distance of more than one mile. The work has demonstrated that there are large bodies of payable silver ores. John M. Akers and Joseph Burkhard are in charge.

The Alamos Mining and Exploration Company has resumed work at Plomosas, 15 miles east of Alamos. This property was opened two years ago and a large body of concentrating ore developed. Further development is to be carried on during this year, and a mill will probably be built soon. Alvino Lloyd is manager.

Idaho 1910 Production

According to statistics furnished by F. C. Moore, State mine inspector of Idaho, the production of the State for 1910 was as follows: Gold, 49,289 fine oz.; silver, 7,890,388 oz.; lead, 239,144,570 lb.; copper, 5,827,639 lb.; zinc, 5,995,600 lb. The total estimated value is $17,135,696, an increase of $1,528,834 over the preceding year.

PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

B. B. Thayer has returned from Montana.

Simonds & Burns have moved their offices from 60 Wall to 55 Liberty street, New York.

E. C. Clapp has been appointed manager of La Luz hacienda, at Coscotitlan, Pachuca, Mexico.

Prof. R. H. Richards has gone to Montana and will make a somewhat extended visit in the West.

A. Bement, consulting engineer, has moved from the Fisher building to 206 South La Salle street,, Chicago.

John C. Greenway, manager of the Calumet & Arizona mines at Bisbee, has been appointed a regent of the University of Arizona.

William Miller Booth, chemist and engineer of Syracuse, N. Y., has established a branch office at No. 299 Broadway, New York.

A. G. Kirby, manager of the Nova Scotia mine, Cobalt, Ont., has been appointed general manager of the Moneta mine, Porcupine.

Malcolm M. Ray has been appointed chief accountant of Real del Monte & Pachuca Mining Company, at Las Calas, Pachuca, Mexico.

C. H. Buffet has been appointed general superintendent of the mines of the Manhattan Exploration Company near La Dura, Mexico.

Edgar A. Collins, superintendent of the Montana-Tonopah mine, Tonopah, Nev., resigned, to take effect April 1. Mr. Collins will go to South Africa.

James Ashworth, general manager of the Crow's Nest Pass Coal Company, Fernie, B. C., has resigned and is succeeded by W. R. Wilson, of Toronto.

Otto F. Heizer resigned as superintendent of the Nevada Hills mine, at Fairview, Jan. 15, and is now superintendent of the Seven Troughs Coalition mines, at Seven Troughs, Nevada.

Walter Harvey Weed is now examining the property of the Transvaal Copper Company at Cumpas, Sonora, Mexico, having just completed the examination of the Petrazzini mine at Arizpe, Sonora.

R. B. Lamb has been appointed consulting engineer for the Swastika Mining Company, Otto township, Ont. He recently concluded examinations in South Lorrain and Cobalt and has left for Porcupine.

Hyder & Hyder announce the merger of the business of Mildon & Russell, Nacozari, and the Sonora Mining Agency, Moctezuma, with their own engineering business. They have offices at Moctezuma and Nacozari, Sonora, Mexico.

Victor G. Hills, of Denver, has been appointed consulting engineer and general manager of the Scheelite Mines, Ltd., at Moose River, Halifax county, N. S., and will construct a mill for the concentration and magnetic separation of the tungsten ores mined by the company.

J. W. Deetrick has been promoted from superintendent of the Republic Iron and Steel Company's plants in the Youngstown, O., district, to general manager of the company, effective April 1. Peter Gordon, assistant to Mr. Deetrick, has been named manager of the Youngstown plants.

Frank H. Probert has just left Los Angeles for Ray, Arizona, where he will be engaged for four or five days in looking over the property of the Ray Central Company, after which he will go to Guanajuato, Mexico, to make examinations of the mines owned by the Proprietary Mines Company, of America.

Jesse Scobey, has purchased an interest in the Henry E. Wood Ore Testing Company, of Denver, and is now vice-president and secretary of the company. In connection with their regular assaying, chemical and ore testing work, they will act as consulting engineers in the design and equipment of milling plants, and as managers and agents of mining properties for foreign investors.

OBITUARY

Ernest N. Atkins, general manager of the Atolia Mining Company, owner of the second largest tungsten mine in the United States, in San Bernardino county, Cal., died at his home in San Francisco, March 23. He had been ill of pneumonia, but was thought to be recovering. He was 31 years old. His wife and infant child survive him.

Samuel Pyrah, 69 years of age, one of the most prominent and successful coal operators in the block coalfield of Indiana, died at Brazil, Ind., April 1. He was born in Yorkshire, Eng. Believing that the United States offered greater opportunities for the young man, he came to this country a few years after reaching his manhood. He first engaged in the sawmill business, but later in coal mining, to which he devoted nearly 35 years of his life. He owned and operated several mines in the block coalfield and was regarded as an unusually successful operator. In 1873 Mr. Pyrah married Phœbe Bayer, who survives him, with several sons well qualified by experience to continue their father's mining business.

William O. Clymo died at Butte, Mont., Feb. 26, aged 50 years. He was born in Redruth, Cornwall. He came to this country with his parents when a lad of 9 years, and was reared in the town of Pioche, Nev. He went to school in Nevada and there began his life work of mining engineering. He had lived in Butte 29 years. During the greater number of those years he was superintendent of leases for the Butte & Boston Mining Company. Later, he was one of the promoters of the Butte & Ballaklava Mining Company but retired from that company soon after it was fully organized. At the time of his death he was interested with some others, and also with the owner, James A. Murray, in developing the Ticon group of mines. His wife, who was Miss Esther Schwarz, of San Francisco, survives him.

Thomas Rickard died at Berkeley, Cal., March 25, aged 41 years. He was a son of Reuben Rickard, one of the pioneer mining engineers of California, and a nephew of Thomas Rickard, of London. Thomas Rickard was born in France and graduated from the University of California in 1887. He lived in Nevada, practising his profession for a year after leaving college, and then returned to San Francisco, where he took an interest in the firm of Parke, Lacey & Co., sellers of mining machinery. In 1901 he joined J. O. Harron and Alex McCone in buying out the older firm, the name being changed to Harron, Rickard & McCone. He was vice-president of this concern at the time of his death. Mr. Rickard found time to be active in public affairs, having served as mayor of Berkeley, as member of the Chamber of Commerce, and as trustee of the California Institute for the Deaf and Blind. He was prominent in lodge and club circles.

SOCIETIES and TECHNICAL SCHOOLS

Rocky Mountain Club, of New York—On April 15, C. J. Blanchard, of the Reclamation Service, gives an illustrated talk on the work which is being done by the Department of the Interior in reclaiming the arid lands of the West.

Mining Society of Nova Scotia—At the recent annual meeting the following officers were chosen: President, G. J. Partington; first vice-president, Prof. F. H. Sexton; second vice-president, Thomas Cantley; council, C. E. Starr, Hiram Donkin, R. H. Brown, H. E. Coll, A. L. McCallum, A. A. Hayward, Hon. R. Drummond, G. W. Stuart, John Johnston.

Capt. John Ericsson Memorial Society of Swedish Engineers—This society has just moved into new quarters in the United Engineers Building, New York. The society was organized by prominent Swedish engineers in 1907. Its officers are: Carl Geo. P. de Laval, president; Karl Vesterdahl and Frank Mossberg, vice-presidents; Gust. Pers. Wern, treasurer; Algot Sylven, secretary; Birger Nauckoff, financial secretary; John Bergeson, librarian; J. E. Fries, master of ceremonies.

Editorial Correspondence

Reports from our own Representatives on Important Events from Many Important Mining Centers of the World

San Francisco

April 7—Whatever the judicable status of the action of the U. S. postal authorities in the matter of recent arrests of mining- and oil-stock brokers, the temporary effect must be salutary. If the authorities in New York and San Francisco make good their charges of fraudulent uses of the mails against the men under arrest it will develop that they have run down some of the old and persistent offenders of this class who have heretofore escaped.

The character of the evidence adduced by the State in the trial of Dr. C. Howard Merritt, charged with issuing a false and misleading oil prospectus, in the Superior court at Oakland, indicates the methods employed by many of the bogus companies that hold out alluring inducements to prospective purchasers of oil and and mining stocks in California. Merritt began operations during the period of Mr. Roosevelt's administration, and named his original enterprise the Roosevelt Oil Company, which he abandoned upon demand of the President. The present company is the Hawaee, which claims to own 6000 acres of the best oil prospects in the State, in Inyo county, near Owens lake. Investigation was made and the defendant brought to trial through the efforts of Lewis E. Aubury, State mineralogist, who has shown that Merritt's company does not own the land, and that it is not oil land. This is one of several similar cases that have been investigated by the State Mining Bureau, some of which have been turned over to the postal authorities with good prospect of conviction through the Federal courts.

The Southern Pacific and the Standard have made public denial of the report of the taking over by the Standard of the railroad's Associated stock. These denials have no effect on the popular belief that there is a deal on for a change in the control of the Associated, and the further fact that the Standard is extending refining facilities at Point Richmond, and has removed the official head of its producing department from San Francisco to Bakersfield encourages the belief that in some way the Standard will eventually become one of only two great producing and marketing concerns in the State, thus placing the entire production and marketing of petroleum in the hands of the Union, the Standard, and the Independents, excepting, of course, the few large operators that have never been wholly dependent upon any of the big corporations. Since the Union has reduced the storage rates to the Independent Agency their relations have been strengthened.

Denver

April 9—The March output of the Cripple Creek mines is now given at 73,125 tons of a gross bullion value of $1,358,455, over $100,000 in excess of February, this being largely due to the open weather and better facilities for transporting ore and for working of plants.

The general mining interests of the State, however, as far as investment or prosperity goes, are unutterably dull. It is no use to disguise it, there is no speculation in mines, no dealing in stocks. Four of the leading mining engineers of this city say this week, that their office doors might as well be closed for all they are doing, or for that matter, have been doing, for over a year. The consensus of opinion of these four engineers is, that the chief reason for it is, that there is no longer an army of men "behind a burro" as of yore, no longer any local pools in the mining camps, grub-staking the prospector, for the merchants in the camps are barely making expenses, so no longer as of yore can the prospector go to the merchant in the springtime and say, "Well! I've got two burros and a camp outfit," and have the merchant answer, "Well! I've got $500 says you can outfit for a summer's work"; and their opinion also is, that both are scared out by the heavy taxation and the stringency of the forest-service rules and the operation of its hirelings. The machinery business likewise is dull and so on all round. Of course, at this time of year the high mines of the San Juan and other regions are still in the grip of winter snows, and blockaded roads, and this contributes somewhat to the universal dullness of the mining industry. Cripple Creek is a notable exception to this, and credit for the same is due to the success of Deep Drainage tunnel in unwatering the mines and so giving a tremendous incentive to prospecting, applications for leases, company work in the now unwatered deep levels, and numbers of long idle properties being "started up" again. Leadville is doing well but the fierce smithsonite excitement has largely abated since the Scottish banquet in the zinc stope. This week the big and unwieldy Yak mill has closed down as it was found it would not pay, but the Yak tunnel and mining enterprise is successful.

Salt Lake City

April 8—Regarding the recent discoveries of lead ore by the Utah Apex in Bingham, the eastern offices have been notified that a large body of shipping grade has been opened. This is a bedded deposit, and has been developed for more than 30 ft. in thickness. The greater part of this body will run 30 per cent. lead, and will be shipped direct to the smeltery. This is one of the most important developments made recently, and is a result of the extensive development which is being done in advance of ore extraction and milling. The mill has been closed down nearly six months, and during this period the management has been devoting its attention exclusively to development, the only ore shipped being that which was taken out in doing this work. During March 1000 tons were sent to the market. Several important orebodies have been opened, and the reserves are in better shape than at any time in the history of the mine. During the past five months over 3400 ft. of new workings have been driven. In the Parvenue section raises have been run from four drifts, and have encountered high-grade lead ore in each case, which proved to be from 40 to 54 ft. in thickness. Milling ore has also been developed. The latest strike is in a different locality than former development. A long crosscut is being driven from the seventh level, 350 ft. above the main tunnel for the Dana and Louise orebodies, which were opened on level No. 4. An ore-bearing fissure has been encountered by this crosscut. Copper ore has also been cut in a raise, and assays 6 per cent. copper, 7.4 oz. silver, and 33 per cent. iron. This ore has been drifted on for 150 ft. Copper ore will not be mined at present, as special attention is being given to the development of the new lead-bearing section. The new fissure cut on the seventh level will furnish ore for the mill, which is to be started up about May 1.

While there has been some talk of cooperation between Utah and Colorado for building a tunnel through the divide at the present terminus of the Moffat road, the general impression appears to be that, since the death of Mr. Moffat, the project has lost its impetus, and for the present at least is not likely to be undertaken.

Butte

April 8—Owing to the general curtailment in the production of copper in the Anaconda company mines, the company has been making many improvements in the mines and surface plants. Development in the mines has been carried to a point where more ore, both high- and low-grade, has been blocked out than has ever before, at one time, been accessible to immediate mining in the camp, and the lower levels of the mines have successfully proven the theory that the orebodies increase in richness with depth. The development of compressed air by the use of electricity, to be used as the motive power of the hoisting engines in the place of steam, will cheapen the production of copper by reducing the consumption of coal. It is thought that the present rate of production will be maintained until an improvement in the metal situation.

Tonopah

April 10—The Tonopah Mining Company has brought suit in the U. S. Circuit Court at San Francisco attacking the legality of the Federal Corporation income tax as applied to mining corporations. The direct object of the suit is to recover $5186 paid to the collector under protest last March, together with the accrued interest. Although the legality of the act was confirmed by the Supreme Court recently, the attorney for the company evokes the Federal constitution, most of his points being under Sections 2 and 9 of Article 1. It is charged that the law is an attempt to levy a direct tax without providing for an apportionment of the tax among the several States of the Union; that the tax is arbitrary and discriminatory; that it takes private property for public use without just compensation, and publishes confidential facts not essential to the collecting of the tax, amounting to "unreasonable search and seizure." Another cause of complaint by the company is that the collector refused to concede that the ore taken out of the mine depreciates the value of the whole property to that extent. Thus there was $1,190,458 worth of rock removed during 1909 which was not taken into consideration in fixing the tax.

Toronto

April 9—A new mining area known as Keekeek, lying 60 miles north of Haileybury, in Quebec province, is attracting many prospectors. It is about 20 miles wide, extending from Lake Opasatika to Lake Missinable. About 60,000 acres have been staked and several finds of free gold are reported. The Mines Department of Quebec is making every effort to attract prospectors and conditions have been made very favorable to them. Every holder of a mining license is allowed to stake and record 200 acres without charge. This will hold his claim for one year, after which he must do 25 days' work and pay 50c. per acre rental.

It is understood that the Ontario Government, as the result of the investigation, recently undertaken to ascertain the output of the silver mines of Gowganda and Elk Lake, requiring transportation facilities, declines to build an extension of the Temiskaming & Northern Ontario Railway at present. It is prepared, however, to accept the alternative proposal recently submitted to them by those interested and will grant a charter to any private company that is found to undertake the work.

Porcupine

April 5—E. A. Wallberg, who controls the British Canadian Power Company, of Cobalt, which supplies compressed air and electricity to a large number of the mines there, has announced that he has made final preparations for entering into the Porcupine field. A good water power has been secured at Wawaitin falls, which is only a short distance from the center of the district. It will, of course, be necessary to wait until the railroad is running before the machinery can be taken in.

A spectacular stampede occurred a few days ago at Cochrane, which is the present terminus of the railway. A speck of gold was found in a concrete chimney among the sand and gravel, and there was an immediate rush to stake all the gravel pits in the neighborhood. Large amounts of gravel were lying along the streets of the town and this was assiduously panned by the excited inhabitants. Numerous specks of gold, and even an occassional small nugget was found, but it is to be feared that the discoveries are hardly as important as the stakers would like to believe.

During the last week of March nine new Porcupine mining companies, with an aggregate capitalization of $9,580,000 obtained charters. Altogether the capital of the mining companies of this new district will total nearly $40,000,000, and new companies will be promoted all the time. These figures sound a note of warning, because, at the present time there are only two properties which have large reserves of ore already blocked out, and although there are a number of extremely promising prospects, a large number of promoters are advertising shares in companies that are palpably wild cats.

Public attention has been turned almost entirely to the gold shares and as a consequence the Cobalts have suffered. Some of the more important companies will shortly have their shares on the market, and so far there has been little difficulty in having the shares underwritten. The duplication of the names of many of these companies is liable to cause trouble, and should be more carefully supervised by the government.

Chihuahua

April 5—During the latter days of March there was some improvement in conditions, political and revolutionary, so that mining operations were somewhat bettered. The contingency of the Chihuahua plant of the American Smelting and Refining Company being closed down on account of coke and coal shortage was dispelled by the opening of freight traffic south and the arrival of sufficient supply to not only preclude an early shut-down, but also to permit of the blowing in the fifth and last furnace. The supply of lime rock has been ample and will so continue so long as the Orient railway, running to the east, is kept open. The greatest shortage is in silicious ore, which comes mainly from the south and west, but this is somewhat relieved by regular shipments from Parral and vicinity. No ore has been moved from the west since early in March, on account of the tie-up of the line of the Mexican Northwestern by the insurrectos. However, the insurrectos did permit the moving of outgoing supplies during the latter part of the month, so that provisions and mine supplies, including dynamite, have been received by several companies, which would have been otherwise compelled to close down indefinitely. The majority of the large mines in the western part of the State are operating uninterruptedly, although the camps are in control of the insurrectos, who, however, appear from all accounts, to be preserving as good order as does the government. Chihuahua city experienced for the first 16 days of March a monotonous period of "incommunicado," having no train or mail service, and with only occasional telegraphic communication anywhere. Some food stuffs were advanced in price by foreign merchants in particular, but when it was learned that there was ample stock of necessities for at least two months and traffic was resumed to the south, normal prices prevailed again. It is not anticipated that the railroad south will be again tampered with, so that little or no anxiety is felt over the situation. The National Railway has abandoned its effort to put in shape the 200 miles of railroad between here and El Paso, as experience has demonstrated its futility so long as the insurrectos are in the field. As fast as the last repairs were made they were destroyed by the insurrectos, who followed closely in the wake of the guarded repair crews. Within and about the city there were during the latter days of March about 2500 federal soldiers, and this force was considered ample for the protection of the city in the event of long-heralded attack by the 4000 insurrectos, known to be surrounding the city within a radius of 50 miles.

The Mining News

Reports of New Enterprises. New Machinery. Installations. Development Work and Property Transfers. The Current History of Mining

Alaska

Press despatches of April 11 state that the entire business district of Iditarod City has been destroyed by fire.

Valdez-Bonanza—Ore in a 5-in. vein, some of which is half gold and which will average $15,000 to the ton, has been discovered on this property on Mineral creek near Valdez, adding much to the excitement in this districts.

Amalgamated Development Company—This company has six wells down, three of which are yielding 1200 bbl. of petroleum per 24 hours. A dock is being built on Controller Bay for the company's use, and preparations are being made to ship 20,000 bbl. of oil. Charles O'Connor, Katalla has charge of the work.

Eureka-Alaska Exploration Company—This new corporation has been formed to operate in Iditarod and other districts. A. R. Abrahamsen, of Eureka, Cal., is president.

Arizona

Cochise County

Copper Belle—The company has won its suit involving the bond given to the Shannon Copper Company, and it is expected that the company will recover its property, which is developed extensively.

Gila County

Miami—Until the ore pocket at Miami's main shaft is completed it will be impossible to hoist sufficient ore to supply more than two units of the concentrator. About 200 tons of concentrates were shipped April 3 to Cananea. Unit No. 4 at the concentrator was given a preliminary run April 3. Unit No. 1 will probably be started soon and work is being rushed on units 5 and 6. One churn drill is working at the extreme northwestern portion of Miami ground close to the Inspiration line, and another has resumed work on the Pascoe group also in the northern part of the property.

Superior & Boston—The 1000-ft. station in the McGaw shaft, has been finished and a 3000-gal. pump installed.

Pinal County

Camp Bonito—This company, of which Col. W. F. Cody is president, reports the discovery of a deposit of scheelite at the property in Old Hat district. The tungsten is associated with gold ore in a shale formation.

Yuma County

Yuma Copper Company—The company is taking a referendum vote among its shareholders on the future policy that shall be adopted. The company has secured an extension for one year on final land payment of $23,000, due in April, but the treasury is exhausted, and no commercial ore has been developed by either the shaft or the diamond drill.

Clara Consolidated—E. D. Ellson, secretary, anounces that the smeltery at Swansea will resume shortly.

California

Eight suits have been filed against the Selby smelting company, charging damages to crops and injury to health of persons residing on the opposite side of Carquinez straits from the smeltery, at Vallejo. The last two suits filed are for $11,700 and $18,500, respectively. Smelters have formerly paid alleged damages where the claims were small, in order to avoid legal expenses and delays; but the ease with which such damages have been collected seems to have encouraged higher expectations.

Eldorado County

Murdock—This drift gravel mine at Nigger flat, near Placerville, has been bonded to P. K. Kelsey, of Lewiston, Idaho, and others, who will reopen it on an extensive scale. The mine has been worked with a 5-stamp mill for several years by the owners, W. and Thomas Murdock.

Good Luck—This mine, near Diamond Springs, which was closed on account of bad weather, will be worked with a larger force by Robert Mitchell, of Berkeley.

Fort Jim—The old 800-ft. tunnel on this gravel mine on the Newtown channel has been opened for 300 ft. When the full length of the caved portion of the tunnel has been opened machinery will be installed. Dr. J. W. Hyatt and Henry Steitz have a purchase option.

Imperial County

Discovery of placer gold 15 miles east of Brawley and about 20 miles northeast of Holtville has caused a rush into the desert. The nearest drinking water is 10 miles distant, though water for panning is found at a depth of 40 ft. in the camp, which is known as District No. 11. Frank Rochefort and John Whitlock, of Holtville, are among the locators.

Kern County

Windy—After much dead work the vein has been found in this mine near Randsburg at the 140-ft. level. Two feet of milling ore is being mined in the drift.

Mascot—High-grade rock is being extracted from this mine south of Randsburg. Powell & Humphreys are owners.

Phoenix—A 500-ft. winze will be sunk on the vein in this mine near Johannesburg. The 5-stamp mill is in steady operation.

Ajax—This mine, near Johannesburg, has been financed, and a shaft is being sunk on a seam of $50 rock. J. M. Beach, of Los Angeles, is manager.

Placer County

Beaver Dredge Company—This company, of Los Angeles capital, is building a new dredge on the Hawk ranch, near Rocklin, to cost $124,000, dimensions 40 by 90 feet.

Hidden Treasure—Mining will be resumed as soon as the snow is off. Harold Power, of Auburn, is owner.

Plumas County

Bushman—These placer mines, on Black Hawk creek near Quincy, are being put in operation after being idle during the winter on account of the snow. Captain Adams, of San Francisco, manager.

San Bernardino County

It is reported that William H. Crane, president of the American Lithia & Chemical Company, of New York, and principal owner of the Pala mines, has recommended the construction of a plant at San Bernardino for the treatment of the lithia ores, which have been formerly shipped to New York for treatment.

Calzona Mines Company—A hoist was recently installed, and the shaft sunk 110 ft. Work will be continued during the summer. Dr. R. M. Vermilye, Calzona, is manager.

Steece Copper Company—The shaft on this mine, near Calzona, is down 380 ft., and will be continued. A. W. Martin, Calzona, manager.

Santa Barbara County

G. H. Brown has located 2½ miles of ocean beach near Santa Barbara and will work the black sand and gravel which he claims yields about 32c. per cu.yd. In high tide the pay sand and gravel has a width of 20 ft., which at low tide is increased to about 100 feet.

Santa Maria Petroleum and Pipeline Company—This is a new incorporation of

San Francisco and Berkeley capital formed to operate in Santa Maria field. Samuel Sussman, San Francisco, president.

TUOLUMNE COUNTY

Tarantula—Twenty stamps are being installed at this mine, near Sonora. Thomas Russell, superintendent, has resigned.

Kanaka—This mine, near Groveland, which was a dividend payer until litigation caused a shutdown, will be put in operation. L. E. Parr is manager.

Great Lone Star—This mine, at Chinese camp, has been sold to the United Gold Mine and Milling Company, of London, operating adjoining properties. The price is reported to be $150,000.

Slap Jack—The ownership of this mine, which has been in litigation for 12 years, has again been decided vested in the Evalina Gold Mining Company.

Colorado

BOULDER COUNTY

Great activity is manifested in building milling plants for the treatment of low-grade sulpho-telluride ores of this district. Two large ones are now under construction and nearly completed, and a third is to be started soon by the Metal Mining Association, of which John R. Wood is secretary. These are all cyanide plants.

The Colorado Metals and Chemicals Company is turning the old Bailey mill, at Eldora, into a modern cyanide plant of 50 tons capacity.

Strong demand at higher prices for tungsten, it is stated, has again opened all the properties at Nederland producing that class of ore.

CLEAR CREEK AND GILPIN COUNTIES

The Camp Beshear "gold excitement," about which so much was said a few months ago, has not been heard of lately, and the "excitement" has apparently much abated. But a report is now rife that 3 ft. of ore "showing free gold" has been found in the Lone Jack, on Lincoln mountain. It is also stated that there are 50 tons of gold ore, worth $40 per ton on the dump of the Esconado, and that the Black Diamond, near the summit of the mountain, has a 6-in. streak of $60 gold and silver ore.

Western Metals Company—The company which controls the Malm process reports a continuation of tests on ores. A bond issue of $25,000 to complete the Georgetown plant is offered to the stockholders. John L. Malm is president.

LAKE COUNTY—LEADVILLE

Mt. Champion Gold Mining Company—This property, in Lackawanna gulch, has a bed or horizontal deposit of ore, said to have an average grade of $10 per ton in gold, and of which it is claimed there are 90,000 tons in sight. A tramway will be built 9000 ft. from mine to mill site.

Result—This property, under lease to Frank Zaitz, adjoins the Forest City and Robert Emmet, is producing about 1000 tons per month of iron ore, running well in silver.

Baby—The lessees on this property on Iron hill continues to send out shipments of high-grade lead ore, with the oreshoot holding out well.

Garbutt—The Garbutt, on Bruce hill, has four fissure veins of gold and silver ore, and from now on it is stated that the mine will ship 75 tons of $45 ore daily.

Sunday—The lessees on this California Gulch property are shipping about 500 tons per month of lead ore, carrying gold.

Kankakee—This tunnel, in Birdseye district, is in 2900 ft., and will be driven several hundred feet further below any of the veins intersected will be exploited by drifting.

Louisville—Thirty-five tons per day of zinc ore are being shipped from this mine through the Yak tunnel by Harrison Reynolds.

TELLER COUNTY—CRIPPLE CREEK

Cresson—In march the output of this mine was about 2500 tons of $25 gold ore.

Fair Chance—A new strike has been made at grass roots in this property on Gold hill, and 30 tons of mill ore has been shipped by A. T. Rankin, Lessee.

Granite—The properties of this company, on Battle mountain, are credited with an output of 45 cars in March, the average being given at $25 per ton.

Little Clara—This mine, now operated through the Ophelia tunnel by lessees, found a small shoot of high-grade sylvanite ore and have made a shipment, which it is guessed at 3 oz. gold per ton.

Mary McKinney—Two cars of 1½-oz. gold ore per week are being sent out through the Pressler shaft, by Russell & Walker, lessees. The Howard shaft is also producing and the main shaft is being worked on company account.

Stratton's Independence—Results for February, production 2087 tons, averaging 19 dwt. 3 grains per ton; low-grade mine and dump ore milled, 9100 tons. Net working profit at mine and mill departments, $11,062.

SAN JUAN DISTRICT

The March shipment of concentrates from Telluride was 74 cars of 25 tons each, the gold-bullion shipments are not given.

Tomboy—The Exploration Company, of London, reports the returns for March as follows: Mill ran 29 days; crushed 9800 tons; yielding bullion, $38,500; concentrates shipped, $27,000; total, $65,500; expenses, $40,500; profit, $25,000.

Idaho

COUER D'ALENE DISTRICT

Stewart—This company is reported to have paid its indebtedness and accumulated a surplus of $70,000, which will be devoted to the construction of a concentrator of 500 tons capacity at the mine. M. W. Bacon is reported to have made the announcement that an official report of the company's operations, physical and financial, would be issued to stockholders soon.

Carney—This copper company, near Mullan, has awarded a contract for 600 ft. of driving and drifting to D. Martin, of Morenci, Ariz.

Indiana

GIBSON COUNTY

The Northwestern Coal and Supply Company, of Chicago, has entered the Oakland City coalfield and is buying coal land in the vicinity, paying $30 an acre for the coal rights. The company is preparing to sink one or two shafts during the coming summer. Other companies are also purchasing coal rights in the Oakland City field. The Bugg Coal Company home office Oakland City, is drilling several test holes.

SULLIVAN COUNTY

The Union mine, owned by the Consolidated Indiana Coal Company, of Sullivan, has shut down five entries, throwing more than 100 men out of employment. The uncertain state of the market is given as the cause.

Michigan

COPPER

Seneca—This subsidiary company of the Calumet & Hecla has suspended operation. A shaft was put down to 950 ft. and drifting from this point carried on the lode was well defined, but carried little copper. The first level opened showed the ground badly broken.

Oneca—The shaft continues sinking toward the depth from which the rich core was taken. It is bottomed below the sixth level. The surface equipment is capable of handling to 1500 feet.

Calumet & Hecla—The exchange of rock that went into effect the first of the year, whereby the Calumet & Hecla mills stamp only conglomerate rock from its mine and subsidiary, and the amygdaloid rock was handled by the Tamarack and Osceola mill, was discontinued on April 1 and all the companies are again handling their own products.

Isle Royale—This company is replacing the foundations under one of the stamp heads at its mill. This work will probably take about two months to complete and during this time production will be reduced.

South Lake—Development has been practically suspended, awaiting further financing.

Indiana—The shaft at this property is down 100 ft. and is bottomed in a felsite formation. No. 13 drill hole has recently penetrated an amygdaloid formation about 25 ft. wide, showing heavy copper.

Bohemia—This company has suspended exploratory work. A number of drill holes were put down in the eastern portion of its lands without revealing anything of an encouraging nature.

Gratiot—This company suspended operations on April 1, two shafts have been sunk to considerable depth and a large amount of lateral opening done; early in the year a mill run was made, but the rock from the upper levels did not yield well in mineral, although an improvement was noted in the lower levels.

Minnesota

Cuyuna Range

M. Weum, of Moorhead, and J. A. Stetson, of Deerwood and Duluth, have been drilling in lot 3 and NW¼- SW¼- Sec. 4- T 46- R 28.

Ossipee—The Whiteside interests of Duluth have five drills at work on the Van Horn farm about three miles from Ossipee, 16 miles north of Brainerd.

June Lake Iron Company—C. W. Potts, of Superior, has been drilling for the June Lake Iron Company, on 71 acres, leased from Congdon & Hartley, in sec. 9- T 46- R 29.

Mesabi Range

Scranton—This mine, south of Hibbing will at last enter the shipping list this season. The concrete shaft, 150 ft. deep, was recently completed by the Foundation Company, of New York, and drifting is in progress from the bottom of it. A steel shaft house is now being erected and operations will soon be in progress.

Vermilion Range

Winton Vermilion Iron Company—This Minneapolis company has been incorporated to operate on the Vermilion range. The incorporators are George I. Graham, George Salzer, and H. D. Carmack, capital $500,000. The tract which will be explored lies in Lake county, northeast of Winton. Machinery will soon be installed.

Murphy Robinson—J. Pfeiffer has sold his interest in this claim, near Armstrong lake, to B. Everett, of Tower. Mr. Pfeiffer expects to start work in sec. 19- T 62- R 14.

White Iron Lake—The drill on this property in sec. 4- T 61- R 15, is reported still in the ore.

Chicago Vermilion—The shaft is down 60 ft and at that depth is in slate, the latter being supposed to lie between the greenstone and the orebody. The intention is to drift at the 100-ft. level. The land adjoins the Rice Bay property and it is hoped that the same high-grade ore will be found by the Chicago Vermilion as at the Rice Bay.

Montana

Butte District

Anaconda—At the Badger State mine stope work was stopped for a time about a month ago, and on the 1300-, 1600- and 1800-ft. levels crosscutting, drifting and raising, for development of the orebodies, is being actively carried on. There are 150 men on the payroll at present, and 300 tons of ore are being hoisted daily. The new building containing the mine offices, and accommodations for 150 miners, has been completed. At the Mountain View mine the work of changing and alining the hoist, preparatory to the use of compressed air, is nearing completion, though it is not yet known how soon mining will be resumed there. It was lately found that the main shaft was out of plumb 6 in. from the collar to the 200 level, caused by a shifting of the ground in an easterly direction, and it was found necessary to jack the timbers over and shift the headframe.

Davis Daly—In the Colorado mine a strike was recently made on the 1700-ft. level in the east drift from the north crosscut. On March 10 the vein at the breast was 2 ft. wide and ran 29.5 oz. in silver and 25.1 per cent. copper to the ton. The drift has now been run 80 ft. showing copper glance, bornite, and covellite, running from 9 per cent. to 30 per cent. copper, and from 12 oz. to 33 oz. in silver, with the vein from 2 to 3 ft. wide. To further develop this vein an east crosscut has been started from a point north of the 1700-ft. station to intersect the vein, which is estimated to be 200 ft. distant.

South Butte—In the case of the South Butte Mining Company against the Butte & Veronica Mining Company and Michael J. O'Ferrell, to establish its ownership of the Veronica quartz claim, Judge Rasch, at Helena, on April 3, 1911, granted a decree in favor of the complainants.

Cascade County

Big Silver—A rich orebody was recently struck at this property, near Neihart, but bad air has made it necessary to stop work until better ventilation can be obtained.

Johannesburg—This gold property was closed down on March 29 the entire force laid off, and the pumps pulled.

Deerlodge County

George—Patrick Wall, of Butte, managing director of the Silver Lake Mining Company, which has purchased the George mine, together with Mayor Charles P. Nevin, of Butte, and Charles Bostrom and Thomas McGrath, of Anaconda, has completed an inspection of the property. There is about $100,000 worth of high-grade ore on the dump, and according to an estimate made by Mr. Wall and Arthur Cory, consulting engineer, there is $600,000 of ore blocked out in the mine. As soon as repairs are made on the wagon road from the mine to the railroad spur, Mr. Wall intends to put 100 men to work.

George Hill—Charles A. Brown, Albert Rivers, Godfrey Limshown, C. E. Farnsworth, H. A. Conyne, Barry Falk, Alexander Ehlert, James Drumgoole, John Davies, W. H. Woehler, and T. P. Stewart, all of Anaconda, have filed articles of incorporation of the George Hill Mining Company, capital $100,000, par $1 per share. The property adjoins the George mine. As soon as machinery and supplies, which have been ordered, arrive at the mine, work will be started.

Granite County

Trout—Ex-Senator Clark, of Butte, who owns this property at Tower, near Phillipsburg, has leased it to Michelson Brothers & Co., of Tower, who will install a gasolene hoist and operate above water line. This was a famous mine some years ago, and it is believed there is still ore in the upper levels.

Jefferson County

Oscar Hodgens, who for some years has been working a claim on the summit of Old Baldy, a mountain in the Elkhorn district, has opened one foot of gold-silver ore.

Amazon—Drifting on the 350-ft. level has opened up an oreshoot 18-in. wide containing gold, silver and lead and the first shipment of ore will shortly be made. The vein where the oreshoot was struck is 5½ ft. wide.

Boston & Corbin—General Manager Emerson's report to Jan. 1, 1911, shows that 192,800 tons of ore are blocked, and recommends the building of a concentrator. President Amster says it is the desire of the stockholders to more fully develop the vein by drifting on the 12th level, to which depth the shaft has been sunk.

Nevada

Esmeralda County

The report of the State bullion-tax collector for Esmeralda county, indicates that the total for the quarter ended Dec. 31, 1910, was $31,760, as compared with $25,885 for the preceding quarter, or an increase of $5785. Of this amount the Goldfield Consolidated contributed $30,438, the Florence Goldfield, $315, and the Silver Peak $1006.

Lyon County

Mason Valley—The company has contracted with the American Bridge Com-

pany for 400 tons of structural steel for the blast and converter building, sampling mill, power house and ore-bin girders, costing approximately $40,000. This contract follows the one recently placed for electrical equipment, involving $22,000. The smeltery is expected to go into commission Sept. 1. The plant, when completed, will have cost $500,000.

NYE COUNTY

MacNamara—The company announces that it will construct a mill of 2000 tons monthly capacity. Stamps, tube mills and cyanidation will be used. Work on the mine has been discontinued pending the construction of the mill. The mill will be at the shaft.

West End—The company has bought the Midway mill at Tonopah and will reconstruct it. The mill is 20 stamps and has a capacity of 120 tons daily.

Tonopah-Belmont — For the quarter ended Feb. 28, the company reports cash resources, $1,161,996; gross earnings, $809,950; net earnings, $437,027, or 29 per cent. on the capital.

STOREY COUNTY

Comstock Securities Company—This company has been organized in New York to acquire the shares in the various Comstock companies. Franklin Leonard Jr., is president.

Mexican—The strike on the 2500 level is still attracting attention because of the grade and extent of the new orebody.

WHITE PINE COUNTY

Giroux—The main working shaft is completed to the 1400-ft. level. Three drifts are being run from the station at the 700-ft. level on the main shaft, and two drifts at the 1000-ft. level. Crosscutting is in progress from the 1400-ft. station toward the Alpha workings. A pump with a capacity of 600 gal. per min. has been ordered for the 1400-ft. station. The permanent hoisting plant at the new shaft is working smoothly.

New Mexico

Indian Copper Company—This company is developing the Hermosa property at Hanover which it has under bond and lease. Two Star drills are at work and holes have been sunk to 300 ft. on the Keystone claim. Another drill is at work on the Accident No. 1 claim. This claim adjoins the western boundary of the Chino. W. R. Cox is in charge. The company is controlled by the Gunn-Thompson syndicate.

Pennsylvania

Philadelphia & Reading Coal and Iron Company—The financial statement for the eight months of the fiscal year, from July 1 to Feb. 28, shows gross earnings, $22,489,665; expenses, $22,202,796; net earnings $286,869. As compared with 1909-10, the gross earnings increased $193,459, but there was a decrease of $650,561 in net earnings.

Utah

Silver King Coalition—Judge Marshall, in the United States Circuit Court at Salt Lake, has awarded judgment against the Silver King Coalition Mining Company, owned principally by former Senator Kearns, of $516,264 and interest, bringing the total to $734,242, in favor of the Silver King Consolidated Mining Company, owned principally by Solon Spiro, on complaint of fraudulent extraction of ore from Vesuvius claim, owned jointly.

JUAB COUNTY

Tintic shipments are holding up to the increase of the last few weeks. For the week ended March 31, 186 cars were shipped, including one car of concentrates from the May Day mill.

Carisa—Development is being done on the 500- and 700-ft. levels. Ore has been produced in the past for nearly half a mile along the strike of the main fissure, but there remain parts of the ground which have not been thoroughly prospected.

Yankee Consolidated—The shaft has reached the 1700-ft. level and a station is being cut. The work has been done by contract up to this point, but from now on the company will take charge of sinking to the water level. It is thought this will be reached short of the 2000-ft. point. The reason for the company's taking over the work is that they do not care to contract for a greater distance than may prove necessary to reach water level. Mineralized quartz was cut a short distance before the 1700 was reached. The dip of the beds is reported to have changed from east to west and back to east again. A statement to stockholders accompanying the assessment notice says that the object is to provide funds for development in sinking and possibly in drifting from the 1700-ft. level in what is regarded as promising territory.

Beck Tunnel—Drifting is being done to the east on a large east and west break, and about a third of the face is in lead ore. Plans are being made for sinking a winze below the present working level. The first shipment of two cars from the new strike has been made, and gave returns in the neighborhood of $2000. Enough ore for another shipment has accumulated in the bins.

Victoria—Drifting has been done on the 1050-ft. level for over 350 ft. in ore from the last 40 or 50 ft., of which several shipments of high-grade have been made. Some of the richest ores are being sacked, and are stated to carry a large amount of silver chloride in a white powdery form. It is planned to install more powerful hoisting equipment, and production will probably be maintained during the installation. The six-drill compressor at the Snowflake, recently purchased by the Victoria, is being removed to take the place of the small compressor now in use. It is reported that a hoist has been purchased from the Opex company, at Mammoth, which will be capable of sinking to about 1700 feet.

Gold Chain—Three feet of shipping ore has been followed from the Dom Pedro claim, owned jointly with the Mammoth, into this company's own territory. The present face is all in ore. The hoisting plant is handling the entire work of the Gold Chain and Opohongo properties.

Lower Mammoth—At the next annual meeting, a proposed increase in the capitalization from 250,000 shares to 1,000,000 shares will be considered. One of the objects is the lowering of the assessment rate which, under the present capitalization is at 5c. a share. There is some talk of a consolidation with the Black Jack; if this should be affected, the 2000-ft. shaft of the Lower Mammoth could be used to advantage in opening up Black Jack territory at depth.

East Crown Point—Arrangements for air have been made with the Knight companies, and it is expected that the work of sinking the 260-ft. shaft will be resumed shortly.

SALT LAKE COUNTY

Bingham-New Haven—This company is shipping about 200 tons of copper ore daily, which runs from 3 to 5 per cent. copper, with some gold and silver. Leasers are working on the upper levels. Some mixed ores carrying lead and copper, part of which will run around $20 a ton, are being mined from a fissure vein. It is expected to start up the 100-ton mill about May 1.

Ohio Copper—According to local reports the new equipment to be installed by Col. E. A. Wall, will be put in shortly. The annual meeting takes place in June, after which it is thought the new interests in the company will take control. It is said that prior to the annual meeting the Heinze interests will turn over the mine, mill and Mascotte tunnel, so that there will be no interference in a reorganization of the board by the New York interests and others. The floating debt has been decreased $100,000 by last year's operations, and the outstanding liabilities, exclusive of bonds, are given in the neighborhood of $500,000. Net monthly earnings are reported to be in the neighborhood of $12,000.

Columbus Consolidated—Arrangements are being made to unwater this property, and it is expected to be ready for operations within three weeks.

UINTAH COUNTY

Dragon Oil and Manufacturing—This is a new company formed in Salt Lake to market the hydrocarbon products produced near Dragon, Utah. W. M. Mathewson is president.

Washington

Ferry County

Surprise—The first carload of machinery has arrived at this mine, near Republic. The ore shipments during February averaged about $2000 per car, 36 cars being shipped.

Trade Dollar—Compressors and electric hoist will be installed on this property. J. W. Lloyd, Republic, is manager.

White Elephant—This mine, which is being operated by the Orient Gold Mines, is being equipped. Frank Ashley, Orient, is superintendent.

Napoleon—The cyanide mill is now in operation.

Stevens County

Swamp King No. 2—Development will be pushed on this property, and hoisting machinery installed. Charles J. Johnson, Spokane, is secretary.

Blue Star—Operations at this mine, which has been closed, will be resumed. Mark Mitchell, Chewelah, is manager.

Copper King—Machinery, including a large diamond drill, has been ordered for this property, near Chewelah. This mine is controlled by the Granby company.

Canada

Ontario—Cobalt

Shipments from Cobalt for March show a decided decrease and totaled only 1819 tons, consisting of 43 high-grade cars and 17 low-grade. This decrease is due to power conditions. The extremely severe winter and the absence of any thaws, has made the water so low that sufficient power cannot be generated to supply air to the mines. As the compressors have been dismantled at some of the mines, while at others the scope of operations has entirely outgrown the capacity of the steam plants, the output has been curtailed.

Crown Reserve—The president's report states that the cash surplus is $659,986, and that the cost of producing silver is 11.97c. per oz. The policy for the present year will be to increase the output and the cash reserve. A mill will probably be built to treat the low-grade ores, of which there is now sufficient to keep a 100-ton mill busy for two years.

Chambers-Ferland—Two high-grade veins have been found on the 200-ft. level of this Cobalt property.

Coniagas—The production on this Cobalt property is rapidly increasing. For 1910 the total output was about 2,000,000 oz., while for 1911, in January alone, 400,000 oz. were produced.

La Rose—This property is maintaining its good position, and during the first two months of the year shipped 623,222 oz., which gave a net profit of $224,705.

Erie Cobalt—An order has been granted for the winding up of this property. Liabilities are about $30,000.

Wettlaufer—This South Lorrain property has been transferred to the Mines Finance Company, of America.

McKinley-Darragh—Production from this Cobalt property for three months ended March 25, totaled 625,000 oz. A new oreshoot has been opened up on the 250-ft. level.

Beaver—The new vein on the 300-ft. level is 8 in. wide and carries 2900 oz. of silver to the ton.

Nova Scotia—The statement of profit and loss as of Oct. 31, for this Cobalt company, shows expenditure, $137,228; receipts, $72,959; making a deficit for the year of $64,268, and a total deficit of $235,064. The company spent $124,790 on capital account. From Nov. 1 to March 1, bullion has been shipped showing returns of approximately $100,000, leaving a net profit for reduction of liabilities of about $38,000.

Ontario—Porcupine

Success—The property of this company, consisting of four Tisdale claims adjoining a portion of the Bewick-Moreing holding on the north and the Armstrong-McGibbon to the east and south, has been taken over by a syndicate headed by S. R. Clark. The new company will have a capital of $2,000,000.

Hollinger—Some important changes have been made in the plans of this company. The original scheme for the custom mill called for 30 stamps but made no provision for the treatment of concentrates. The Merrill Metallurgical Company, of San Francisco, will put in three tube mills, one to each 10 stamps. This is expected to give a crushing capacity of 270 tons per day. A diamond drill is being installed to test the orebody.

Foley-O'Brian—This property, where high-grade ore has been found in No. 1 shaft, which is now down 68 ft., has passed into the hands of the newly formed Foley-O'Brian company.

Callinan—This property, adjoining the West Dome, has been sold for a price stated at $225,000 to American purchasers, said to be interested in the Ford Automobile Company.

Shillington-Richardson—These two locations, immediately north of the Armstrong-McGibbon holdings at the east end of Pearl Lake, have been acquired by the Porcupine Gold Trust for $150,000. Twenty men have been put to work on the property.

Standard—A boiler and steam hoist have been installed. Two shafts are now down more than 40 ft. A good find was recently made at the bottom of the shaft, running high in free gold.

Dome—All the machinery and supplies for this Porcupine property are now on the ground. Work on the 40-stamp mill is progressing rapidly.

Mexico

Chihuahua

International Gold Mines Company—This company, which is successor to the Socorro Mines and Development Company and owns property in the Socorro camp reached via Ocampo, is winding up its affairs preparatory to abandonment of its properties which have proven on systematic development of too low grade to permit of profitable operation. Several hundred thousand dollars have been expended in development and equipment. The cessation of operations is on recommendation of the latest consulting engineer, J. Gordon Hardy. The main offices of the company are in Kansas City. It is stated that the company will be able to clean up all outstanding indebtedness.

Americana—Shipments of lead ore from this Terrazas mine are being made in wagons to Chihuahua by Felix McDonald, the leasing operator.

Hinds Consolidated—This company is succeeded by the newly organized Reforma Mining and Milling Company, the Cleveland stockholders in the former company having stock control in the new company. This property is in the Santa Barbara camp.

Durango

The Inde camp has been the scene of some insurrectionary trouble but operations have been molested but little. The large companies, notably the Inde company, Inde Reduction Works and Guadalupe, are maintaining normal production.

Mexico Consolidated—The affairs of this company operating in the Guanacevi camp are being reorganized by F. Stallforth and other large stockholders preparatory to resumption of work on a systematic scale.

Lucia—The management of this company operating in the vicinity of Estacion San Gabriel on the Durango branch of the National, has called for bids on a 75-ton cyanide plant for immediate erection.

Mexico

El Oro—Returns for March were: Mill ran 29 days; crushed 28,910 tons; yielding bullion, $207,410; working expenses, $105,200; expenditures on development, $19,850; profit, $78,360; railway profit, $9000; total profit, $87,360.

South America

Chile

Famatina Development Company—This company's smelting plant in February treated 2850 tons of ore, producing 3 tons of blister copper and 246 of matte, assaying 34 per cent. copper, 4.18 oz. gold and 58.3 oz. silver per ton. During February operations were greatly hampered by floods, which, however, it is hoped are now over for the year.

The Markets

Coal Trade Review

New York, April 12—The coal trade in the West is still lagging behind, and mine operators are complaining of small sales, short time at mines and difficulty in selling their coal at remunerative prices. Late cold weather gave some impetus to domestic trade, but it was only temporary. The Lake trade shows no sign of an early opening.

Coal trade in the East is quiet and shows no change in conditions.

Southern Coal Rates—Final arguments have been heard by the Interstate Commerce Commission in three cases against the Southern Railway Company. All charge discrimination in rates by the railroad company in favor of certain districts, its apparent object being to prevent competition and confine each coal producing district to a special territory.

Coal Traffic Notes

Anthracite shipments in March were 5,996,894 tons, being 925,946 tons more than in February, and 822,728 tons more than in March, 1910. For the three months ended March 31 the shipments were, in long tons:

	1910	1911	Changes
Reading	3,035,041	3,137,200	I. 102,159
Lehigh Valley	2,672,321	3,008,256	I. 335,935
N. J. Central	1,892,366	2,174,042	I. 281,676
Lackawanna	2,282,051	2,287,953	I. 5,902
Del. & Hudson	1,558,154	1,885,975	I. 327,821
Pennsylvania	1,571,499	1,630,470	I. 58,971
Erie	1,830,817	2,165,028	I. 334,211
N. Y., Ont. & West.	670,319	683,035	I. 12,716
Total	15,512,568	16,971,959	I. 1,459,391

The total increase this year was 9.4 per cent. All the companies showed gains, the larger increases being on the Lehigh Valley, the Erie and the Delaware & Hudson; the smallest on the Delaware, Lackawanna & Western.

Shipments of Broad Top coal over the Huntingdon & Broad Top railroad three months ended March 31 were 205,254 tons in 1910, and 172,597 in 1911; decrease, 32,697 tons.

Coal receipts at Boston, three months ended March 31, reported by Chamber of Commerce, long tons:

	1910	1911	Changes
Anthracite	402,523	409,463	I. 6,940
Bituminous	983,014	970,584	D. 12,430
Total domestic	1,385,537	1,380,047	D. 5,490
Foreign	69,011	64,880	D. 4,131
Total	1,454,548	1,444,927	D. 9,621

The foreign coal is almost all from Nova Scotia mines.

New York

Anthracite

April business in domestic sizes opened up well. Local dealers were generally shy on stocks, owing to the cold weather in March, and were quite ready to fill up their yards on the April discounts. The mine shipments in March were heavy and seem to have taken up readily. Steam sizes are reasonably active.

Schedule rates on domestic sizes for April are $4.25 for lump, $4.50 for egg and stove and $4.75 for chestnut, all f.o.b. New York harbor. On steam sizes quotations are: Pea, $3@3.25; buckwheat, $2.40@2.80; No. 2 buckwheat or rice, $1.90@2.30; barley, $1.45@1.75; all according to quality, f.o.b. New York harbor.

Bituminous

Both coastwise and harbor trade have shown an improvement, but it is slight. Contract making is the main topic, but it goes forward slowly. There was some stir over a reported drop in West Virginia coal, but it turned out to be only a local sale in Boston of some demurrage coal, not a contract.

Prices are about the same. For steam coals the lowest prices named are $2.40 @2.50, New York harbor, for lower grades, with higher-grade coals up to $2.85@2.95. A fair Miller vein coal can be had about $2.60@2.65. Gas coals are in rather light demand at $1.05@1.10 for ¾-in., $1@1.05 for run-of-mine and 70 @75c. for slack, all at mines.

Stocks of coal at tidewater are pretty well limited to demand. Both Pensylvania and West Virginia mines are running short time and not shipping much ahead.

Storms and fog have delayed vessels in the coastwise trade, and this has made boats a little short in supply and held off the decline in rates, which usually comes about this time. Current rates are unchanged, vessels asking 75@85c. from Philadelphia to Boston or Portland; 65@ 70c. from New York to points around the Cape; 30@40c. to Providence and the Sound. From Norfolk and Newport News the rates are 75@85c. to Boston or Portland.

Current Prices of Metal, Minerals, Coal and Stocks, Conditions and Commercial Statistics

Birmingham

April 10—The coal trade has not yet recovered from its temporary depression, but better business is expected soon. The attention of coal men is absorbed this week by the terrible accident in the Banner mine of the Pratt Consolidated Company, and there is little discussion of business.

Chicago

April 11—Quiet conditions exist in the coal market, with supplies kept down fairly close to current needs, and the aggregate of sales large, though naturally less than a month ago. With plenty of coal in sight, the average steam user buys for a short time ahead, and often. The retailers are laying in good stocks, in the country towns especially, of domestic coals. Screenings continue to be the strongest size, with much Illinois and Indiana lump 5c.@15c. lower in price than it was two or three weeks ago. Contract business is increasing, at prices generally a little lower than obtained last year.

In general, Illinois and Indiana coals sell for $1.80@2.30, lump; $1.70@1.80 run-of-mine, and $1.60@1.85 for screenings. Coals from east of Indiana are steady and in fair demand, Hocking bringing $3.15 and smokeless $3.30@3.65 for lump and $2.95@3.15 for run-of-mine. Anthracite, under the stimulus of the April discounts, is selling very well.

Cleveland

April 10—Coal is beginning to come to Cleveland for the Lake trade, but there are no vessels ready to take it; and none are likely to be ready for some weeks. The shipments from the mines are not wanted yet.

The cold spell has lasted long enough to give domestic trade quite a boost locally. Steam trade is beginning to look up a little. Prices are unchanged.

Indianapolis

April 10—Local trade in domestic coal has been stirred up by the unseasonable cold weather. Steam trade is about the same.

A conference of the State tax commissioners with a number of county assessors was held last week. It is understood that an agreement was made to assess coal land on a general basis of $15 per acre of underlying coal.

Pittsburg

April 11—A moderate tonnage of coal has been shipped in the Lake trade, but little if any has left the ports. Several mines are now running largely on Lake coal, and as a result operations are considerably heavier. Commercial demand continues very light, but prices continue on the firmer basis already noted, being approximately as follows: Mine-run and

nut, $1.15; ¾-in., $1.25; 1¼-in., $1.35; slack, 75c. per ton at mine.

Connellsville Coke—The coke market has continued quiet, which is only natural considering that pig-iron production proceeds at an unchanged rate and practically all the coke required had already been covered. In the absence of transactions we quote former prices: Prompt furnace, $1.60@1.65; balance first half, $1.65@1.70; second half, $1.75@2; prompt foundry, $2@2.10; contract, $2.20 @2.40 at ovens.

The *Courier* reports production in the Connellsville and lower Connellsville region in the week ended April 1 at 368,029 tons, a decrease of 3000 tons, and shipments at 3936 cars to Pittsburg, 6207 cars to points west and 927 cars to points east, a total of 11,070 cars.

St. Louis

April 10—The weather has been quite sharp for April and the market has been just a little better for the past week than for some time. Dealers have been doing a nice business as a number of consumers have been coming back for small orders to finish out the season. As a consequence the demand for domestic sizes and carlot stuff has been a little heavier, though there has been no change in price. The market, on the whole, seems to be a trifle better than last month. In spite of the fact that lump coal has been moving a little more freely this week, screenings also have stiffened up and seem to be gaining strength; 75c. per ton at mine is easily the price for Standard screenings and there will very likely be an advance in price in the near future.

Current prices on the St. Louis market are nominally as below:

Illinois, Standard:	Mine	St. Louis
6-in. lump and egg	$1.10	$1.62
2-in. lump	1.00	1.52
Mine-run	0.90	1.42
Screenings	0.60	1.12
Trenton:		
6-in. lump and egg	2.25	2.77
3-in. nut	2.00	2.52
Staunton or Mt. Olive:		
6-in. lump	1.50	2.02
2-in. lump	1.25	1.77
Mine-run	1.20	1.72
Screenings	0.60	1.12
Carterville:		
6-in. lump or egg	1.30	1.97
3-in. nut	1.20	1.87
Mine-run	1.10	1.77
Screenings	0.75	1.42
Pocahontas and New River:		
Lump or egg	2.25	4.75
Mine-run	1.25	3.75
Pennsylvania Anthracite:		
Chestnut	....	7.20
Stove or egg	....	6.95
Grate	....	6.70
Coke:		
Connellsville foundry	....	5.40
Gas house	....	4.90
Smithing	....	4.15

Prices on track at East St. Louis are 20c. lower than St. Louis quotations as given above.

High-grade coal is slow locally and the demand for it for both steam plants and domestic use has been very light owing to the abundance of Standard coal on the market and the low prices prevailing.

Anthracite—The market is good and considerable April coal seems to be coming forward now. Sales on the whole are satisfactory and agents are anticipating a better market this year than last.

Calgary, Alberta

April 8—The miners in the Crow's Nest Pass district and in Alberta, struck April 1, on the expiration of the old agreement, March 31. Since then the striking miners have held several meetings to discuss the question of applying to the Government board to arbitrate differences with operators, but nothing definite has been decided. Operators have refused steadily to take the initiative, claiming that the question of open shop, which is the main point in dispute, cannot be the subject of arbitration. Meantime the supply of fuel all over eastern British Columbia and Alberta is reaching a low ebb, even railways having trouble securing a supply.

FOREIGN·COAL·TRADE

German Foreign Trade—Exports and imports of fuel in Germany in January, metric tons:

	Exports.	Imports.	Excess.
Coal	1,953,781	639,941	Exp. 1,313,840
Brown coal	5,401	555,573	Imp. 550,172
Coke	417,018	46,420	Exp. 370,598
Briquets	182,273	19,410	Exp. 162,863
Total	2,558,473	1,261,344	Exp. 1,297,129
Total, 1910	2,221,154	1,233,063	Exp. 988,091

Exports this year included 1335 tons of coke to the United States.

German Coal Production—Coal production in German Empire, month of January, long tons:

	1910.	1911.	Changes.
Coal	12,425,893	13,527,215	I. 1,101,322
Brown coal	5,628,361	6,319,544	I. 691,183
Total mined	18,054,254	19,846,759	I. 1,792,505
Coke made	1,902,710	2,225,037	I. 322,327
Briquets made	1,550,810	1,789,128	I. 238,318

Of the briquets reported this year, 1,383,503 tons were made from brown coal, or lignite.

Nova Scotia Coal—Shipments of coal from Nova Scotia mines two months ended Feb. 28, long tons:

	1910	1911	Changes
Dominion	342,252	370,845	I. 28,593
Nova Scotia Steel	74,347	56,177	D. 18,170
Acadia	45,087	59,611	I. 14,524
Intercolonial	37,168	40,544	I. 3,376
Inverness	38,827	39,658	I. 831
Total	537,681	566,835	I. 29,154

The total increase this year was 5.4 per cent. Only one company showed a decrease.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report prices of coal on March 11, as follows: Best Welsh steam coal, $4.14; seconds, $3.90; thirds, $3.78; dry coals, $3.84; best Monmouthshire, $3.72; seconds, $3.54; best small steam coal, $2.40; seconds, $2.16. All prices are per long ton, f.o.b. shipping port, cash in 30 days, less 2½ per cent. discount.

IRON·TRADE·REVIEW

New York, April 12—The iron and steel markets remain about stationary. Conditions have not changed, and do not seem likely to change materially for a time.

The market is suffering from a complication of troubles. There is the delay in the rendering of the Supreme Court decisions in the "trust" cases; this is regarded as delay because business interests had been expecting the decisions to be rendered April 3. Then there is the Interstate Commerce Commission's decisions in the advanced-rate cases, and finally the extra session of Congress. These probably only accentuate conditions. From 1899 to 1907, inclusive, a great deal of new work was done, requiring increasing tonnages of iron and steel. Thereafter the amount of new work decreased, whereas productive capacity greatly increased. The ordinary needs of the country fall far short of engaging the full capacity. The revival of January-February had not proceeded far until it was seen that there was no prospect of full capacity being reached, which made the market sensitive to the three disturbing influences mentioned.

The Lake Superior ore interests have been canvassing the situation with a view to settling the question of prices for the coming season, but find themselves confronted by a very trying situation. There is no lead in the pig-iron market, for there is no price for ore above cost to the more expensive mines which would yield the merchant blast furnace any fair profit.

The Steel Corporation's report showing unfilled orders of 3,447,301 tons on March 31, a gain of 46,758 tons during March, surprises the steel trade, for since the corporation is well known to have been operating at the rate of between 70 and 75 per cent. during March, the booking must have been at the rate of between 75 and 80 per cent. of capacity, and this does not agree with the experience of other steel manufacturers. There is every prospect, at any rate, that next report will show a material decrease.

The Harriman Pacific railroads have placed orders for 72,000 tons of rails. The order was divided among the Colorado Fuel and Iron Company, the Illinois Steel Company and the Tennessee Coal, Iron and Railroad Company. Other small orders for rails make up a total of about 28,000 tons.

Pig Iron Production—The reports of the blast furnaces, as collected and pub-

lished by the *Iron Age* show that on April 1 there were 231 coke and anthracite furnaces in blast, having a total daily capacity of 70,750 tons; an increase of 4200 tons over March 1. Making allowance for the charcoal furnaces, the estimated production of pig iron in March was 2,216,200 tons; for the three months ended March 31 it was 5,826,200 tons. Of this total 3,832,350 tons are credited to the stacks owned and operated by steel companies. Notwithstanding the increased rate of production, it is estimated that unsold and unused stocks of pig iron have been reduced about 120,000 tons in the past two months.

Baltimore

April 10—Imports for the week included 846 blooms and 5231 bars charcoal iron from Sweden; 870 tons ferromanganese from Great Britain; 17,115 tons iron ore from Cuba.

Birmingham

April 10—The market is still quiet and new orders have not been plentiful. Some people think that a good business could be done if prices were cut below $11 for No. 2 foundry, but makers are not disposed to give way below that point.

Charcoal iron contines strong around $22 per ton. Scrap is stronger and demand is improving.

The Blast Furnace Committee of the Steel Corporation has been visiting this district, making a thorough examination of the furnaces, looking into the ore and coke supplies and discussing practice.

Chicago

April 11—The demand for pig iron is restricted to needs of the next one to three months, generally. Melters feel the market occasionally with an inquiry for good-sized tonnage on last-half delivery, but most of them appear to be convinced that prices will not rise soon. Furnace agents are more willing than they have been for several weeks to make contracts for the last half at low prices, little difference existing now between quotations for early and late delivery. These conditions point to continued weakness of the pig-iron market, as those who have to do with local requirements see matters. Neither Southern nor Northern iron appears to have an advantage and consumers show no strong preference.

Sales of iron and steel products show no falling off, with the leading lines, railroad and structural materials, increasing slightly from week to week. Coke is very quiet at $4.75 for Connellsville.

Cleveland

April 10—No change in iron ore. No action on prices is in sight, and the current figures will likely be continued by default.

Pig Iron—The market is still slow, based on small orders chiefly. No change in prices is reported.

Finished Material—Quite an active business is going in light material—wire, rail-joints, bolts, nails, etc.; also a fair business in bars. Quite a number of structural orders are under consideration. Plates and sheets are quiet.

Philadelphia

April 12—The pig-iron market has been rather quiet and the inquiries that were looked for a week or two ago are still in abeyance. A good deal of business expected by local furnace interests has slipped through their fingers to Southern furnaces. Most of the iron sold in this market is No. 2 X foundry. With two or three exceptions all the orders have been small. Offers have just been received for forge from several mills; users of pig iron are hanging to their policy of close buying. Transactions in basic which have been talked of for several weeks are still not closed. Consumption of pig iron is on the increase and as only a few consumers are protected by contracts an improving demand for current requirements cannot be far off. Special brands have sold at outside figures while some contracts for pipe iron have been closed at even shaded quotations from the last purchases made. Current quotations for No. 2 X are $15.75; for the better grades of gray forge $14.75. In small lots there is very little difference between Southern and Northern brands. Where a large sale is possible the Southern makers cut close to the bone.

Steel Billets—After a long delay users of billets have finally decided to buy and their orders have given a little temporary activity to the market.

Bars—For the first week in several months the bar mills have done what they regard as a good business. Jobbers and retailers have decided to stock up and their requisitions have depleted assortments at mills. Prices, of course, continue weak and there is no probability of any improvement.

Structural Material—Office and general building requirements are quite a feature at present. Business is coming from a great many cities and towns along the Atlantic coast, involving shop construction, hotel work and railroad-shop work. The tone of the market is improving week by week.

Scrap—The scrap supply is in excess of current demands and prices are weak. Holders of scrap in desirable quantities are holding their stock at prices which dealers are not disposed to pay, excepting where they find customers.

Pittsburg

April 11—The past fortnight in the iron and steel trade has been the dullest for a long time; in fact, some observers of many years' experience regard the paralysis which has fallen over the iron and steel trade as absolutely unprecedented. The market has fallen flat in practically all departments. Buying is on the most reduced scale, while specifications against regular contracts for finished-steel products are reduced. Production has only slightly decreased, but nothing is more certain that that there will have to be a material decrease in the very near future unless stocks are to be accumulated, and this is quite improbable, being entirely contrary to the new spirit of the steel trade.

Prices show slightly more irregularity than a week ago. There has been considerable shading in sheets, covering nearly all descriptions; both billets and sheet bars have been sold at cut prices, there is one report of a cut price made on plates, and the scrap market has suffered a further decline. Sales of heavy melting-steel scrap have been made at $13, the lowest price for nearly three years.

Pig Iron—The market has been absolutely stagnant, sales being extremely light, while there is practically no inquiry. Prices have not definitely declined, but possibly only because there has been no real test. We continue to quote: Bessemer, $15; basic, $13.75; No. 2 foundry, $14@14.25; malleable, $13.75, all at Valley furnaces, freight from Pittsburg being 90 cents.

Ferromanganese—A sale of 1000 tons of ferromanganese for delivery over the next three months to a Youngstown steel interest has been made at $36.75, Baltimore, and a sale of 500 tons for prompt delivery to a Kentucky plant at $37, Baltimore. The market is quotable roundly at $37, Baltimore, for prompt or forward, freight to Pittsburg being $1.95 per ton.

Steel—Regular steel makers are holding prices as formerly, at $23 for billets and $24 for sheet bars, Pittsburg or Youngstown, with rods at $29, Pittsburg. There has been a little shading in open-hearth material, but only of odd lots, there being no open quotations at cut rates. A sale of about 250 tons of open-hearth bars was made to a sheet mill just west of Pittsburg, at 50c. under the regular delivered price, and a sale of about the same tonnage of open-hearth billets to a point somewhat further west at a slightly greater cut.

Sheets—The sheet manufacturers met in Pittsburg this afternoon to discuss the price cutting which has become more pronounced in the past week or two. The attendance was fairly good, but not as large as at previous meetings, held Jan. 7 and Feb. 11. Every effort is being made to keep information from leaking out as to what occurred at the meeting. Regular prices, which are being shaded to an extent, particularly in certain districts, remain as follows: Black sheets, 2.20c.; galvanized, 3.20c.; blue annealed, 1.65c.; painted corrugated, $1.55; galvanized corrugated, $2.75 per square.

St. Louis

April 10—The pig-iron market has been a little bit brighter and a number of inquiries have been received during the last week. A number of concerns are looking around for third-quarter delivery iron, but do not seem to be willing to pay any advance over present prices; any buyers of considerable tonnage could place an order for third-quarter delivery at $11 per ton, Birmingham, though producers are holding out for an advance of 50c. per ton on smaller lots. Current price is $14.75 per ton, St. Louis, or $11, Birmingham, for No. 2 foundry.

FOREIGN IRON TRADE

Swedish Foreign Trade—Exports of iron and steel from Sweden for the full year, in metric tons:

	1909.	1910.	Changes.
Pig and scrap	112,800	143,500	I. 30,700
Ingots, blooms, etc.	49,900	70,400	I. 20,500
Wire and wire rod	22,500	36,300	I. 13,800
Other iron and steel	131,000	171,100	I. 40,100
Total	316,200	421,300	I. 105,100

The exports in 1910 not only showed a heavy gain over 1909, but they were 3000 tons greater than in 1907.

United States Foreign Trade

Iron and Steel—Exports and imports of iron and steel and of machinery in the United States for the two months ended Feb. 28, are valued as below by the Bureau of Statistics of the Department of Commerce and Labor:

	1910.	1911.	Changes.
Exports	$28,462,476	$37,430,759	I. $8,968,283
Imports	6,280,306	5,120,543	D. 1,159,763
Excess, exp.	$22,182,170	$32,310,216	I. $10,128,046

Increase in exports, 31.5; decrease in imports 18.5 per cent. The leading items of exports and imports were, in long tons:

	Exports 1910.	Exports 1911.	Imports 1910.	Imports 1911.
Pig iron	7,340	25,787	37,264	30,327
Scrap	658	8,827	14,475	7,836
Billets, blooms, etc.	4,676	35,291	5,215	14,079
Bars	15,290	24,410	5,386	4,895
Rails	76,485	63,007	....	.....
Sheets and plates	44,583	43,816	993	426
Structural steel	17,795	30,374	.....	.....
Wire-rods	1,876	1,661	1,521	3,164
Wire	22,680	28,031	.....	.....
Nails and spikes	6,002	11,700	.....	.....
Tinplates	1,680	5,070	10,970	6,550
Pipe and fittings	25,008	27,876	.....	.....

Imports of wire not reported in quantity; values were $208,550 in 1910, and $205,479 in 1911. Imports of rails and structural steel not reported separately.

Iron Ore Movement—Imports and exports of iron ore in the United States, two months ended Feb. 28, long tons:

	1910.	1911.	Changes.
Imports	455,250	197,420	D. 257,830
Exports	8,513	4,688	D. 3,825

The imports this year included 160,250 tons from Cuba, 26,507 from Spain, 5729 from Sweden and 528 from Canada.

Manganese Ore—Imports of manganese ore into the United States two months ended Feb. 28 were 44,433 tons in 1910, and 27,128 in 1911; decrease 17,305 tons.

METAL MARKETS

New York, April 12—The metal markets show no material change, and for the most part continue quiet and without special interest.

MONTHLY INDEX NUMBERS

Month	1910	1911	Month	1910	1911
January	127	110	July	112	.....
February	124	115	August	113	.....
March	118	112	September	114	.....
April	118	.....	October	111	.....
May	113	.....	November	117	.....
June	107	.....	December	115	.....

Year 1909, 115; 1910, 115.
Numbers for each month and year calculated on approximate sales of pig iron, copper, tin, lead, zinc and aluminum.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Feb. 1911	$ 424,733	$ 5,805,844	Imp. $ 5,381,111
" 1910	2,937,134	3,063,116	Imp. 125,982
Year 1911	1 348,409	15,346,674	Imp. 13,998,265
" 1910	9,100,266	5,194,473	Exp. 3,905,793
Silver:			
Feb. 1911	4,453,171	3,897,946	Exp. 555,225
" 1910	4,588,619	3,155,329	" 1,433,290
Year 1911	10,104,247	7,449,472	" 2,654,775
" 1910	9,086,923	7,403,683	" 1,683,240

Exports from the port of New York, week ended April 8: Gold, $456,952, principally to Cuba; silver, $1,123,525, chiefly to London. Imports: Gold, $205,043; silver, $245,047, from Mexico and Central America.

Gold—The price of gold on the open market in London remained at 77s. 9d. per oz. for bars and 76s. 4½d. per oz. for American coin. Supplies were divided, going to Germany, India and the Bank of England.

Transvaal gold output in March was $13,974,264; making for the three months ended March 31 a total of $40,056,992, or $3,240,229 more than in the first quarter of last year.

Platinum—The market is firm in sympathy with those abroad. Quotations are a shade higher, dealers asking this week $41@41.50 per oz. for refined platinum, and $43.50@44 for hard metal. A further advance is expected.

Our Russian correspondent writes, under date of March 30, that the market has a strong tendency, owing to reports of advances in Paris. Prices are subject to important fluctuations. Current quotations for crude metal 83 per cent. platinum, are 9.35 rubles per zolotnik at Ekaterinburg and 35,000 rubles per pood in St. Petersburg—$35.16 and $34.30 per oz. respectively.

Paris quotations reported are 7250 fr. per kg.—$43.52 per oz.—for refined platinum.

Iridium—The metal is scarce and $62 per oz is quoted, with a firm tendency.

Silver—The market continues steady with a slight tendency to advance. Purchases have lately been made which would appear to indicate that China has been a buyer to a considerable degree.

SILVER AND STERLING EXCHANGE

Apr.	6	7	8	10	11	12
New York	53	53	53⅛	53⅛	53⅛	53¼
London	24 7/16	24 7/16	24½	24½	24½	24 7/16
Sterling Ex.	4.8625	4.8620	4.8630	4.8630	4.8625	4.8630

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Exports of silver from London to the East, Jan. 1 to March 30, as reported by Messrs. Pixley & Abell:

	1910	1911	Changes
India	£1,431,500	£2,408,300	I. £976,800
China	1,088,500	702,800	D. 385,700
Total	£2,520,000	£3,111,100	I. £591,100

India Council bills in London brought an average of 16.06d. per rupee for the week.

Messrs. Samuel Montagu & Co., London, say, under date of March 30: "The recent purchases of silver coin in Saigon, Indo-China, by the Chinese government are believed to amount to $10,000,000, or £1,000,000. This represents a redundance of currency in consequence of the heavy purchases made some years back by the French government, which have since proved to have been unnecessarily large."

Copper, Tin, Lead and Zinc

NEW YORK

Apr.	Copper: Lake, Cts. per lb.	Copper: Electrolytic, Cts. per lb.	Tin: Cts. per lb.	Lead: New York, Cts. per lb.	Lead: St. Louis, Cts. per lb.	Zinc: New York, Cts. per lb.	Zinc: St. Louis, Cts. per lb.
6	12⅛ @12⅜	12.00 @12.05	41½	4.40 4 42½	4.25 @4.27½	5.37½ @5.42½	5.22½ @5 27½
7	12¼ @12⅜	12.00 @12.05	42½	4.40 4.42½	4.25 @4.27½	5.37½ @5.42½	5.22½ @5.27½
8	12¼ @12⅜	11.95 @12.05	42½	4.40 4.42½	4.25 @4.27½	5 37½ @5.42½	5.22½ @5.27½
10	12¼ @12⅜	11.95 @12.05	42½	4.40 4.42½	4.25 @4.27½	5 37½ @5.42½	5.22½ @5.27½
11	12¼ @12⅜	11.95 @12.05	41⅞	4.40 4 42½	4.25 @4.27½	5 37½ @5.42½	5.22½ @5.27½
12	12¼ @12⅜	11.95 @12.05	42½	4.40 4.42½	4.25 @4.27½	5.37½ @5.42½	5.22½ @5.27½

The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis New York, cash. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—But relatively little business has been done during the last week, manufacturers both here and abroad having continued to hold aloof. The refinery statistics for March were not well regarded and the unfavorable sentiment created by them explains the willingness of sellers to meet buyers on a lower level for such business as was transacted. In the early part of the week there were sales of electrolytic at 12.20, delivered, usual terms, while in the latter part of-

LONDON

Apr.	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
6	54 5/16	54 7/8	58	189	186	12 3/4	23 3/8
7	54 3/16	54 3/4	57 3/4	194 1/4	189 1/4	12 1/2	23 1/2
8	.....	.....	.....	.....	.....	.....	.....
10	54	54 1/16	57 3/4	194 1/2	189 3/4	12 7/8	23 5/8
11	53 13/16	54 3/8	57 1/2	192 1/8	187 1/2	12 1/2	23 5/8
12	53 5/8	54 1/4	57 1/2	194	189	12 1/2	23 3/4

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

fers at 12⅛c. were rather freely made. The market suffers from the uncertainty as to the probable action of the largest seller, which has been holding aloof for several months past. In Lake copper the market has also been quiet. Some small sales of special brands for the later deliveries have been made as high as 12½c., but good, ordinary brands have sold at 12⅜c., and that price can scarcely be obtained on business of consequence.

At the close, Lake copper is quoted at 12¼@12⅜c., and electrolytic copper in cakes, wirebars and ingots at 11.95@12.05c. Casting copper is quoted nominally at 11¾@12c. as the average for the week.

Copper sheets are 18@19c. base for large lots. Full extras are charged, and higher prices for small quantities. Copper wire has been advanced ¼c. and is now 13¾c. base, carload lots at mill. Some cutting in wire prices is still reported, but only to a moderate extent.

The London market for standard copper has been quiet and weakish, and at the close is quoted at £53 12s. 6d. for spot, and £54 5s. for three months.

Copper exports from New York for the week were 5927 long tons. Our special correspondent gives the exports from Baltimore for the week at 211 tons.

Beer Sondheimer & Co., have made a contract with the British Columbia Copper Company to refine and sell its copper. The refining will be done at the Raritan works.

Tin—The domestic market seems to have, for the time being at least, emancipated itself from London influence. Sales throughout the week were made at a considerable discount from the importation basis, and at no time, even when London showed an advance overnight of £5, as on April 17, did the New York market evince any excitement. The large backwardation for three-months tin, against spot tin, is not very much liked, and does not augur well for the inherent firmness of the market. The close is quoted at £194 for spot and £189 for three months in London, and about 42⅛c. in New York.

Exports of tin from Bolivia in 1910 are reported at 38,548 metric tons of *barilla*, or concentrates, equivalent to 23,129 tons of metallic tin. This is an increase over 1909 of 2982 tons of *barilla*, or 1789 tons of tin.

Lead—There is a fair demand from day to day. The spring demand is somewhat slow in making itself felt. The market is a trifle lower at 4.25@4.27½c., St. Louis, and 4.40@4.42½c., New York.

The London market is firmer, Spanish lead having advanced to £12 18s. 9d. and English lead to £13 1s. 3d. per ton.

Spelter—There has been relatively little business done in spelter, and the demand is freely met. The market has been somewhat mixed by speculative cross-purposes, but while some transactions have been made at an advance in price, there have been sellers right along at 5.25, and we quote the market unchanged at 5.22½@5.27½c., St. Louis, and 5.37½@5.42½c., New York.

The London market is firm and has advanced to £23 15s. for good ordinaries, and £24 for specials.

Base price of zinc sheets has been reduced ¼c., and is now $7.25 per 100 lb., f.o.b. La Salle-Peru, Ind., less 8 per cent. discount.

Other Metals

Aluminum—Sales have been a little better, but the market remains quiet, with prices unchanged. We quote 20½@21c. per lb. for No. 1 ingots.

Antimony—The market is steady, with a fair business doing in a quiet way. Quotations are 9½@9⅝c. per lb. for Cookson's; 9@9⅛c. for U. S.; while business is done at 8⅜@8⅝c. in Chinese, Hungarian and other outside brands.

Quicksilver—Spot supplies continue scarce, and prices are in accordance. Spot in New York is $54 per flask, but metal "to arrive" can be had at $50. San Francisco quotes $52.50 for domestic orders and $50 for export. London price is £9 5s. per flask, with £9 4s. quoted by second hands.

Spanish Metal Exports

Exports of metals and minerals from Spain, month of January, reported by *Revista Minera*, in metric tons:

Metals.	1910.	1911.	Changes.	
Pig and manuf. iron	1,940	4,427	I.	2,487
Copper	1,291	1,117	D.	174
Copper precipitate	1,320	1,111	D.	209
Lead	12,745	13,316	I.	573
Zinc	235	27	D.	208
Quicksilver	213	....	D.	211
Minerals.				
Iron ore	805,567	787,886	D.	17,681
Manganese ore	416	4,074	I.	3,658
Copper ore	98,474	63,595	D.	34,879
Lead ore	403	374	D.	22
Zinc ore	12,908	7,879	D.	5,029
Pyrites, iron	113,886	122,930	I.	9,046
Salt	45,647	41,165	D.	4,484

Imports of phosphate of lime 10,727 tons in 1910, and 7164 in 1911; superphosphates and basic slag, 9537 tons in 1910, and 8008 in 1911; nitrate of soda, 7049 tons in 1910, and 2252 this year.

Zinc and Lead Ore Markets

Platteville, Wis., April 8—The base price paid this week for 60 per cent. zinc ore was $39@40 per ton. The base price paid for 80 per cent. lead ore was $52@53 per ton.

SHIPMENTS, WEEK ENDED APR. 8

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Mineral Point	793,000	.....	.....
Galena	586,300	.....	.....
Platteville	407,840	.....	243,500
Shullsburg	85,800	.....	.....
Hazel Green	85,600	.....	.....
Benton	80,500	.....	.....
Cuba City	80,000	.....	86,200
Harker	55,240	.....	.....
Total	2,174,280	.....	329,700
Year to date	36,911,630	2,220,635	9,901,390

Shipped during week to separating points, 2,123,440 lb. zinc ore.

Joplin, Mo., April 8—The highest price paid for zinc sulphide ore was $43, the base ranging from $36 to $40.50 per ton of 60 per cent. zinc. Zinc silicate ore sold on a base of $18@24 per ton of 40 per cent. zinc. The average price, all grades of zinc, was $37.14. The highest price paid for lead ore was $59, with competition at fever heat among the three local smelters. The Webb City smelter is buying over the line in Kansas, and the Galena, Kan., smelter is bidding up on Webb City ore, while the Picher company, in Joplin, is bidding all around high enough to keep the price up and take their usual quota. The average price, all grades, was $56.96 per ton.

Producers are holding public meetings and soliciting producers who do not intend to join in the movement to sign powers of attorney to a committee of five to close contracts for the weekly sale of 3000 tons of ore. The idea is to comply in every way with the law, giving the committee full power without returning the contract for the producers' approval. The smelters have declined to sign the association schedule, not on account of the scale of prices, but because the producers ask permission to withhold sale of ore for four consecutive weeks. Should they obtain such concession and all join together in withholding ore for four consecutive weeks, it is quite apparent that it would upset market conditions. Some smelters ask for a stated tonnage each week. This would be an impossibility in this mining region, but the producers should be willing to agree to sell the mine output each week, if the smelter is bound to take it each week they want to sell. There is no objection to the schedule scale of prices, and there should be no trouble in the producers and smelters agreeing further. The two interests,

which must work in harmony to secure the best results to each, are nearer together than ever before, and it is probable, with the settlement of contracts placed in the hands of a committee of five, that a full agreement will be reached.

SHIPMENTS, WEEK ENDED APR. 8

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	4,213,270	.....	1,047,980	$109,916
Joplin	2,225,020	.....	222,650	51,402
Galena	449,440	.....	188,520	14,147
Granby	78,720	717,670	23,590	11,605
Alba-Neck	314,390	.....	.....	6,759
Spring City	187,720	185,320	33,290	6,611
Duenweg	247,270	66,540	13,380	5,869
Carthage	278,500	.....	.....	5,291
Quapaw	178,210	.....	66,090	4,734
Oronogo	56,130	.....	97,000	3,822
Aurora	159,390	62,400	.....	3,714
Carl Junction	179,590	.....	.....	3,591
Sarcoxie	75,870	152,980	.....	3,276
Badger	89,090	.....	.....	1,781
Totals	8,733,110	1,184,910	1,692,500	$232,518
14 weeks	129,654,630	8,961,060	24,290,810	$3,382,122
Blende, the week,	$169,168;	14 wks.,		$2,603,017
Calamine, the week,	15,137;	14 wks.,		106,969
Lead value, the week,	48,213;	14 wks.,		672,136

MONTHLY AVERAGE PRICES

Month	Zinc Ore				Lead Ore	
	Base Price		All Ores		All Ores	
	1910	1911	1910	1911	1910	1911
January	$47.31	$41.85	$45.16	$40.55	$56.99	$55.68
February	40.69	40.21	39.47	39.16	53.64	54.46
March	43.60	39.85	39.71	38.45	51.26	54.77
April	41.00	.....	39.33	.....	49.72	.....
May	40.19	.....	37.51	.....	48.16	.....
June	40.20	.....	37.83	.....	48.80	.....
July	39.63	.....	36.80	.....	48.59	.....
August	40.13	.....	37.32	.....	49.75	.....
September	43.45	.....	39.96	.....	54.73	.....
October	43.31	.....	40.50	.....	53.18	.....
November	47.20	.....	43.20	.....	54.80	.....
December	42.50	.....	40.70	.....	55.70	.....
Year	$42.43	.....	$39.79	.....	$52.12	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

CHEMICALS

New York, April 12—The general market is unchanged, business being rather quiet.

Copper Sulphate—Sales are steady and supplies a little better. Prices are unchanged at $4 per 100 lb. for carload lots and $4.25 per 100 lb. for smaller orders.

Arsenic—Dullness is the order of the day and prices have weakened again. Quotations are $1.85@1.90 per 100 lb. for white arsenic.

Nitrate of Soda—Business is fair in this article, but the position is not too strong. Prices have shaded off a little, and 2.10c. per lb. is quoted for both spot and futures.

Potash Salts—A despatch from Berlin, Germany, April 11, says: "It was announced at a meeting of the German potash syndicate Monday, that in accordance with the wish of that organization, representatives of all the American interests concerned in the potash question will come to Berlin to carry on negotiations for a final settlement of the disputes. All political questions will be entirely excluded from the discussion. The syndicate will ask the government to levy the super-tax on potash provided for by law while the negotiations are proceeding."

Graphite

Exports of graphite mineral from Ceylon are reported at 70,306,544 lb. in 1909, and 70,623,728 in 1910; an increase of 317,184 lb., or 0.4 per cent. The exports in 1910 included 36,792,224 lb. to the United States; 14,862,624 lb. to Germany; 11,592,224 lb. to Great Britain; 6,026,384 lb. to Belgium; 1,350,272 lb. to other countries,

MINING·STOCKS $

New York, April 12—The general stock market has remained quiet and slow, with small changes in quotations and no definite tendency apparent. Public interest is turned away from the Exchange and outside dealings are still limited.

One sale of Homestake was reported during the week, 25 shares changing hands at $86 per share.

On the Curb also trading was slow and fluctuations only of a fractional kind. The Cobalt stocks, which were the most active section of the market, have settled down. Cobalt Central and La Rose were the only stocks traded in to any extent, and they maintained their prices with hardly any change. Little was done in copper stocks, Braden Copper being the only one showing sales, which were at a small decline. Other mining stocks were almost dead for the time being.

At auction in New York, April 6, a $200 certificate Comstock Tunnel first-mortgage income-bond scrip brought $28; 200 shares Comstock Tunnel stock, 26c. per share; $74,000 Orleans County Quarry Company first-mortgage bonds, $500; $370,000 debentures and 1480 shares Orleans County Quarry Company stock, $1200 for the lot.

April 11—Mining stocks are heavy and a trifle off during the week. This is due largely to a lack of interest which causes a sagging tendency. There is no apparent weakness in the situation and the declines do not carry any significance. Coppers, like everything else, are awaiting the important Supreme Court decisions.

In the meantime things are monotonously dull, and no relief from this state of affairs is in sight. The fact that the Boston Stock Exchange will move into its new quarters April 17, does not promise anything in the way of public interest.

The reported rich strike in the North Butte mine would have given quite a boost in the price of that stock in normal times, but it was passed almost unnoticed. Knowledge of it, however, created a little activity, which has given it strength of late, although today it ran back to $27.25. The Calumet & Hecla issues remain dead, while Calumet stock is off to $483 per share.

COPPER PRODUCTION REPORTS

Copper contents of blister copper, in pounds

Company	January	February	March
Anaconda	21,000,000	20,900,000	21,900,000
Arizona, Ltd	3,024,000	2,860,000	.....
Balaklala	932,452	676,605	.....
Copper Queen	7,298,227	7,114,278	7,333,629
Calumet & Ariz	2,044,000	1,762,000	.....
Detroit	2,017,397	1,918,365	1,914,710
East Butte	1,134,000	1,065,000	.....
Imperial	.....	.....	.....
Nevada Con	5,268,954	4,992,553	.....
Old Dominion	2,095,000	1,890,000	.....
Shannon	1,250,000	1,166,000	1,322,000
Superior & Pitts	2,014,000	1,808,000	.....
United Verde*	3,000,000	2,800,000	.....
Utah Copper Co	6,707,116	7,329,326	.....
Lake Superior*	15,700,000	17,750,000	20,000,000
Non-rep. mines*	13,900,000	12,600,000	.....
Total production.	87,385,146	86,032,127	.....
Imports, bars, etc.	18,648,920	23,935,222	.....
Total blister	106,034,066	109,967,349	.....
Imp. in ore & matte	5,377,700	5,981,487	.....
Total	111,411,766	115,948,836	.....
Brit. Col. Cos.:			
British Col. Copper	.....	767,470	.....
Granby	.....	1,633,300	.....
Mexican Cos.:			
Boleo	2,647,173	2,226,560	2,700,880
Cananea	3,504,000	3,906,000	3,542,000
Moctezuma	1,738,429	1,950,475	2,049,150

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners.
*Estimated.

STATISTICS OF COPPER.

Month.	United States Product'n.	Deliveries, Domestic.	Deliveries for Export.
III, 1910	120,067,467	62,844,818	40,585,767
IV	117,477,639	67,985,951	31,332,434
V	123,242,476	59,305,222	45,495,400
VI	127,219,188	53,363,196	65,895,948
VII	118,370,003	56,708,175	59,407,167
VIII	127,803,618	67,731,271	61,831,780
IX	119,519,983	64,501,018	75,106,496
X	126,469,284	67,814,172	68,186,912
XI	119,353,463	60,801,992	67,424,316
XII	123,339,219	43,594,018	88,104,075
Year 1910	1,452,122,120	749,426,542	722,431,494
I, 1911	115,696,591	42,078,567	53,208,739
II	109,828,297	50,518,998	45,111,019
III	130,532,080	66,080,789	59,081,127

	Visible Stocks.		
	United States.	Europe.	Total.
IV, 1910	123,824,874	249,625,600	373,450,474
V	141,984,159	246,870,400	388,854,559
VI	160,425,973	239,142,400	399,568,373
VII	168,386,017	232,892,800	401,278,818
VIII	170,640,678	222,320,000	392,960,677
IX	168,881,245	218,444,800	387,326,045
X	148,793,714	211,276,800	360,070,514
XI	139,261,914	198,060,800	337,322,714
XII	130,389,069	193,200,000	323,589,069
I, 1911	122,030,195	236,629,120	358,649,315
II	142,439,490	236,992,000	379,431,190
III	156,637,770	233,385,600	390,023,370
IV	162,007,934	223,014,400	385,022,334

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month. From Jan. 1, 1911, stocks at Hamburg and Rotterdam are included in the visible stocks for Europe.

Curb trading has not brought out any particular features. Butte Central has stiffened to $5.50, and Amalgamated-Nevada has been a strong feature among the penny issues. One or two more Porcupine stocks have been put on the Curb list, but as yet Boston is a slow market for these specialties.

Assessments

Company	Delinq	Sale	Amt
Andes, Cal.	May 2	May 23	$0.10
Belcher, Cal.	Apr. 17	May 8	0.10
Bell, Ida.	Apr. 29	June 6	0.04
Bullion, Nev.	Apr. 14	May 10	0.05
Cedar Creek, Ida.	Apr. 1	May 1	0.002
Challenge, Cal.	Apr. 26	May 27	0.05
Cœur d'Alene Inv't Co., Ida.	Apr. 1	May 1	0.01
Copper King M. & S., Ida.	Apr. 15	May 15	0.01
Crown Point, Nev.	Apr. 7	Apr. 28	0.10
Daisy, Ida.	Apr. 0	May 20	0.001
Dalmatia, Ida.	Apr. 3	May 1	0.005
Ely Consolidated, Nev.	May 2	June 22	0.05
Exchequer, Cal.	Apr. 26	May 18	0.05
Federal Ely, Nev.	Apr. 22	May 8	0.01
Hancock Con., Mich.	May 1		1.00
Log Cabin, Ida.	Apr. 24	May 24	0.006
Majestic, Utah	Apr. 11		0.10
Nevada Superior Mines Co.	Apr. 7	Apr. 22	0.06
Lucky Swede, Ida.	Apr. 1	May 1	0.002
Snowstorm, Cal.	Apr. 10	May 10	0.003
Snowstorm, Ida.	Apr. 14	May 12	0.005
Tintic Standard, Utah	Apr. 25		0.005
Union Con., Nev	Apr. 11	May 3	0.10
Verde May, Ida.	Mar. 29	Apr. 29	0.005
Wabash, Utah.	Mar. 27	Apr. 20	0.10
Yankee Con., Utah	May 1		0.02

Monthly Average Prices of Metals

SILVER

Month.	New York.			London.		
	1909.	1910.	1911.	1909.	1910.	1911.
January	51.750	52.375	53.795	23.843	24.154	24.865
February	51.472	51.534	52.222	23.706	23.794	24.081
March	50.468	51.454	52.745	23.227	23.690	24.324
April	51.428	53.221		23.708	24.483	
May	52.905	53.870		24.343	24.797	
June	52.538	53.462		24.166	24.651	
July	51.043	54.150		23.519	25.034	
August	51.125	52.912		23.588	24.428	
September	51.440	53.295		23.743	24.567	
October	50.923	55.490		23.502	25.596	
November	50.703	55.635		23.351	25.680	
December	52.226	54.428		24.030	25.160	
Total	51.502	53.486		23.706	24.670	

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	New York.				London, Standard.	
	Electrolytic		Lake.			
	1910.	1911.	1910.	1911.	1910.	1911.
January	13.620	12.295	13.870	12.680	60.923	55.604
February	13.332	12.256	13.719	12.611	59.388	54.970
March	13.255	12.139	13.586	12.447	59.214	54.704
April	12.733		13.091		57.238	
May	12.550		12.885		56.313	
June	12.404		12.798		55.310	
July	12.215		12.570		54.194	
August	12.490		12.715		55.733	
September	12.379		12 668		55.207	
October	12.553		12.788		56.722	
November	12.742		12.914		57.634	
December	12.581		12.863		56.769	
Year	12.738		13.039		57.054	

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

TIN AT NEW YORK

Month.	1910.	1911.	Month.	1910.	1911.
January	32.700	41.255	July	32.695	
February	32.920	41.614	August	33.972	
March	32.403	40.157	September	34.982	
April	32.976		October	36.190	
May	33.125		November	36.547	
June	32.769		December	38.199	
			Av. Year	34.123	

Prices are in cents per pound.

LEAD

Month.	New York.		St. Louis.		London.	
	1910.	1911.	1910.	1911.	1910.	1911.
January	4.700	4.483	4.582	4.334	13.650	13.009
February	4.613	4.440	4.445	4.266	13.328	13.043
March	4.459	4.394	4.307	4.238	13.063	13.122
April	4.376		4.225		12.641	
May	4.315		4.164		12.550	
June	4.343		4.207		12.688	
July	4.404		4.291		12.531	
August	4.400		4.290		12.513	
September	4.400		4.289		12.582	
October	4.400		4.271		13.091	
November	4.442		4.314		13.217	
December	4.500		4.363		13.197	
Year	4.446		4.312		12.920	

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York.		St. Louis.		London.	
	1910.	1911.	1910.	1911.	1910.	1911.
January	6.101	5.452	5.951	5.302	23.350	23.887
February	5.569	5.518	5.419	5.368	23.188	23.276
March	5.637	5.563	5.487	5.413	23.031	23.016
April	5.439		5.289		22.469	
May	5.191		5.041		22.100	
June	5.128		4.978		22.094	
July	5.152		5.002		22.406	
August	5.279		5.129		22.800	
September	5.514		5.364		23.165	
October	5.628		5.478		23.900	
November	5.976		5.826		24.083	
December	5.624		5.474		24.019	
Year	5.520		5.370		23.050	

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG.

	Bessemer.		Basic.		No. 2 Foundry.	
	1910.	1911.	1910.	1911.	1910.	1911.
January	$19.90	$15.90	$17.98	$14.40	$17.94	$14.75
February	18.96	15.90	17.21	14.50	17.38	14.81
March	18.53	15.90	16.93	14.65	17.00	14.96
April	18.28		16.84		16.75	
May	17.10		15.94		16.18	
June	16.52		15.60		15.53	
July	16.40		15.40		15.40	
August	16.09		14.89		15.16	
September	15.92		14.73		14.93	
October	15.90		14.05		14.88	
November	15.84		14.26		14.78	
December	15.90		14.15		14.65	
Year	$17.10		$15.65		$15.83	

STOCK QUOTATIONS

COLO. SPRINGS Apr. 11

Name of Comp.	Bid.
Acacia	.02½
Cripple Cr'k Con.	.01½
C. K. & N.	.14
Doctor Jack Pot	.06
Elkton Con.	.64½
El Paso	.73½
Findlay	.05½
Gold Dollar	.11½
Gold Sovereign	.02½
Isabella	.12½
Jack Pot	.05
Jennie Sample	.10½
Lexington	.01
Moon Anchor	.02½
Old Gold	.03
Mary McKinney	.36½
Pharmacist	.02
Portland	1.01
Vindicator	.89½
Work	.03

SALT LAKE Apr. 11

Name of Comp.	Bid.
Beck Tunnel	.33
Black Jack	.19½
Carisa	.17
Cedar Talisman	.09½
Colorado Mining	.42
Columbus Con	.32
Daly Judge	4.60
Grand Central	.98
Iron Blossom	1.40
Little Bell	‡.49
Lower Mammoth	.11½
Mason Valley	8⅛
May Day	.22½
Nevada Hills	3
New York	.10
Prince Con	.57
Silver King Coal'n	1½
Sioux Con	.30
Uncle Sam	.65
Yankee	15½

TORONTO Apr. 11

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	6.95	Dome Exten	.50
Hudson Bay	.90	Pearl Lake	.52
Temiskaming	.67½	Dobie	2.75
Wettlaufer-Lor	.92	West Dome	2.00
Hollinger	8.86	Standard	.30
Preston E. D.	.35	Apex	.17
Porcu. Gold	.56½	Canada	1.07
Porcu. Tisdale	.08½	Crown Char.	.57
Imperial	.15	Carnation	.34
Central	.59	Swastika	.56½

SAN FRANCISCO April 11.

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.10	Belmont	5.85
Belcher	.84	Jim Butler	.23
Best & Belcher	.35	MacNamara	.11
Caledonia	.44	Midway	.18
Challenge Con	.20	Mont.-Tonopah	.77
Chollar	.18	North Star	.10
Confidence	.65	West End Con	.55
Con. Virginia	1.20	Atlanta	.10
Crown Point	.84	Booth	.11
Gould & Curry	.19	C.O.D. Con	.08
Hale & Norcross	.31	Comb. Frac	.11
Mexican	3.95	Jumbo Extension	.30
Occidental	.64	Oro	.06
Ophir	1.80	Silver Pick	.05
Overman	.35	St. Ives	.16
Potosi	.35	Tramps Con	.02
Savage	.40	Argonaut	1.70
Sierra Nevada	.46	Bunker Hill	‡6½
Union Con	1.77½	Cent. Eureka	1.20
Yellow Jacket	.41	So. Eureka	7.40

N. Y. EXCH. Apr. 11

Name of Comp.	Clg.
Amalgamated	61⅞
Am. Agri. Chem.	57½
Am.Sm.&Ref.,com	73½
Am. Sm.& Ref., pf.	104½
Anaconda	37½
Batopilas Min	2
BethlehemSteelpf	62¾
Chino	22½
Comstock Tunnel	.26
Federal M.& S., pf.	59
Goldfield Con	6
Great Nor., ore ctf.	62
Homestake	85
Nat'nalLead,com.	52¼
National Lead, pf.	105⅜
Nev. Consol	17¾
Pittsburg Coal, pf.	81½
Ray Con	15¼
RepublicI&S,com	32½
Republic I & S, pf.	95
SlossSheffi'd,com.	52
Sloss Sheffield, pf	‡105
Tennessee Copper	36¼
Utah Copper	43½
U. S. Steel, com	76¾
U. S. Steel, pf.	119⅛
Va. Car. Chem	66¼

N. Y. CURB Apr. 11

Name of Comp.	Clg.
Ariz.-Cananea	‡33⅛
Barnes King	.18
Braden Copper	4¼
B. C. Copper	5½
Buffalo Mines	2.20
Butte Coalition	17¾
Caledonia	‡⅞
Calumet & Mont.	.20
Cobalt Central	.06
Con. Ariz Sm.	1⅛
Davis-Daly	1 7/16
Ely Con	.18
Florence	1⅝
Giroux	5⅞
Greene Cananea	6 7/16
Greenwater	.05⅛
Guanajuato	3¼
Guerrero	‡1⅞
Guggen. Exp.	193
Inspiration	7⅞
Internat. S. & R.	‡131
Kerr Lake	6¾
La Rose	4 7/16
McKinley-Dar-Sa.	1⅝
Miami Copper	18⅜
Min. Co. of A. new	4 5/16
Moneta Porc.	.20
Mont. Shoshone	‡.04
Nev. Utah M. & S.	1/16
Nipissing Mines	10½
Ohio Copper	1⅞
Pacific Sm. & M.	3/16
Precious Metals	5/16
Ray Central	1½
Red Warrior	‡1⅝
South Utah M. & S.	‡1
Standard Oil	664
Stewart	.92
Tonopah	7 11/16
Tonopah Ex	1.10
Tri-Bullion	¼
Tularosa	‡ 9/16
Union Mines	3/16
Yukon Gold	4

LONDON Apr. 12

Name of Com	Clg.
Camp Bird	£1 12s 6d
Dolores	1 10 0
El Oro	1 4 6
Esperanza	1 14 4½
Mexico Mines	7 11 3
Oroville	0 6 0
Stratton'sInd.	0 2 0
Tomboy	0 15 0

BOSTON EXCH. Apr. 11

Name of Comp.	Clg.
Adventure	5
Algomah	7¼
Allouez	33
Am. Zinc	24¼
Arcadian	2⅛
Arizona Com	13
Atlantic	3
Bonanza	⅛
Boston & Corbin	11⅛
Butte & Balak	4 1/16
Calumet & Ariz	49
Calumet & Hecla	480
Centennial	11⅜
Con. Mercur	.08
Copper Range	60¾
Daly-West	4½
East Butte	11¾
Franklin	9½
Granby	30½
Hancock	22
Hedley Gold	15⅛
Helvetia	1½
Indiana	12⅜
Isle Royale	12¾
Keweenaw	2¼
Lake	31⅛
La Salle	4¼
Mass	6
Michigan	2
Mohawk	37
New Arcadian	2¾
North Butte	27½
North Lake	5½
Ojibway	5¾
Old Dominion	37
Osceola	100
Parrot	11½
Quincy	69
Shannon	10
Shattuck-Ariz.	17¾
Superior	33
Superior & Bost.	3¼
Superior & Pitts.	13¾
Tamarack	37
Trinity	4½
U. S. Smelting	34
U. S. Smelt'g, pf.	45½
Utah Apex	2⅜
Utah Con	13
Victoria	1⅛
Winona	6½
Wolverine	110
Wyandot	1¼

BOSTON CURB Apr. 11

Name of Comp.	Last
Ahmeek	165
Bingham Mines	1⅞
Boston Ely	1⅜
Boswyocolo	.09
Cactus	.13
Calaveras	2½
Champion	.01½
Chief Cons	1⅝
Corbin	3⅜
Cortez	1½
Crown Reserve	3
First Nat. Cop.	1⅞
Live Oak	18½
Mackinaw	.02
Majestic	.34
Nat'l Mine & Ex.	.01
Nevada-Douglas	2 1/16
Oneco	1¼
Raven Copper	.20
Rhode Island Coal	4
San Antonio	‡3½
South Lake	4¼
Trethewey	.90
Tuolumne Copper	4⅞
United Zinc, pfd.	4½
Vulture	7½
Yuma	.02

‡Last quotation.